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# Influenza Virus Patents (Class 424/206.1)

**Therapeutically triggering an innate immune response in a target tissue**

**Patent number:** 11226340

**Abstract:** The invention provides therapeutic compositions that present an artificial repertoire of mammalian pattern recognition receptor (PRR) agonists, so that the pattern of PRR agonists recapitulates a distinct portion of a PRR agonist signature of a mammalian pathogen. The artificial repertoire of PRR agonists may be formulated together in a therapeutic vehicle for combined presentation to an innate immune cell resident in a target tissue in a mammalian host, and the vehicle adapted to deliver the PRR agonists to the target tissue, so as to modulate an immune response.

**Type:** Grant

**Filed:** April 26, 2017

**Date of Patent:** January 18, 2022

**Assignee:** Qu Biologics Inc.

**Inventors:** Harold David Gunn, David W. Mullins, Shirin Kalyan, Momir Bosiljcic, Monan Angela Zhang, Mark Bazett, Marcel Thalen, Dermot McGovern, Boyko Traychev Kabakchiev, Ho Pan Sham

**Herpes simplex virus nanoemulsion vaccine****Patent number:** 11147869

**Abstract:** The present application relates to the field of human immunology, in particular, a herpes simplex virus (HSV) vaccine. The subunit vaccine composition comprises isolated surface glycoproteins from herpes simplex viruses, fusion proteins or fragments thereof mixed in varied combination with a nanoemulsion, which is a potent immune enhancer.

**Type:** Grant**Filed:** November 15, 2018**Date of Patent:** October 19, 2021**Assignee:** BlueWillow Biologics, Inc.**Inventors:** Ali I. Fattom, Jakub Simon, James R. Baker, Jr., Tarek Hamouda, Vira Bitko**Mutations that confer genetic stability to additional genes in influenza viruses****Patent number:** 11046934

**Abstract:** The disclosure provides for an isolated recombinant influenza virus having at least one of: a PA gene segment encoding PA with a residue at position 443 that is not arginine, a PB1 gene segment encoding PB1 with a residue at position 737 that is not lysine, a PB2 gene segment encoding PB2 with a residue at position 25 that is not valine or a residue at position 712 that is not glutamic acid, a NS gene segment encoding a NS1 with a residue at position 167 that is not proline, a HA gene segment encoding a HA with a residue at position 380 that is not threonine, or any combination thereof, and methods of making and using the virus.

**Type:** Grant**Filed:** April 30, 2018**Date of Patent:** June 29, 2021**Assignee:** Wisconsin Alumni Research Foundation (WARF)**Inventors:** Yoshihiro Kawaoka, Satoshi Fukuyama, Shinji Watanabe**Virus-like particles****Patent number:** 11020470

**Abstract:** Provided herein are membrane enveloped virus-like particles (VLPs), and methods of use and synthesis thereof. In particular, yeast-cell-derived VLPs are provided that comprise surface-displayed glycoproteins and/or multiple virally-derived proteins.

**Type:** Grant**Filed:** April 12, 2016

**Date of Patent:** June 1, 2021

**Assignee:** THE REGENTS OF THE UNIVERSITY OF MICHIGAN

**Inventors:** Fei Wen, Eshita Khera, Brett Dallas Hill, Syed Rizvi

**NS1 truncated virus for the development of canine influenza vaccines**

**Patent number:** 10973903

**Abstract:** The present invention relates to compositions and methods for the treatment and prevention of canine influenza virus (CIV) and CIV-related pathology. The present invention is based on the development of mutant CIV, having one or more mutations in segment 8, which induces a CIV-specific immune response in a subject.

**Type:** Grant

**Filed:** August 19, 2016

**Date of Patent:** April 13, 2021

**Assignees:** University of Rochester, Cornell University

**Inventors:** Luis Martinez-Sobrido, Aitor Nogales-Gonzalez, Colin Parrish

**Universal influenza vaccine using cold-adapted live-attenuated virus**

**Patent number:** 10953086

**Abstract:** Disclosed is a universal influenza vaccine composition and corresponding methods comprising at least one attenuated live-attenuated influenza vaccine. The vaccine composition can exhibit a cross-protective effect against a wide range of influenza viruses and can ensure a strong protection efficacy, a wide range of protection, and safety. In addition, a vaccination method of heterologous live vaccines of the present invention induces various immunological effects so that cross-immunogenicity and cross-protective ability are remarkably increased, and thus is expected to be usefully utilized as a universal influenza prevention method. A person who has a basal immunity through infection with an influenza virus or vaccination with an influenza vaccine can be regarded as being in a state where primary vaccination has already been performed, single vaccination with a live vaccine induces an enhanced cross-immune response, and thus it is possible to expect a wide range of protective effects against various viruses.

**Type:** Grant

**Filed:** February 1, 2019

**Date of Patent:** March 23, 2021

**Assignee:** INDUSTRY-ACADEMIC COOPERATION FOUNDATION, YONSEI UNIVERSITY

**Inventors:** Baik Lin Seong, Yo Han Jang, Young Ho Byun

**Method and kit for quantifying vaccine****Patent number:** 10942181

**Abstract:** The present disclosure provides a method for quantifying a vaccine. The method includes the steps of: 1) providing a plurality of standard mixtures, each of the standard mixtures having a standard antigen and an aluminum based adjuvant; 2) mixing a stabilizing solution with the vaccine and each of the standard mixtures; 3) determining dosages of the standard antigens in the standard mixtures to establish a standard curve; and 4) determining a dosage of a target antigen in the vaccine according to the standard curve.

**Type:** Grant**Filed:** May 24, 2019**Date of Patent:** March 9, 2021**Assignee:** Adimmune Corporation**Inventors:** Juine-Ruey Chen, Chia-Ying Wu, Yung-Tsung Chen**Bivalent swine influenza virus vaccine****Patent number:** 10905756

**Abstract:** The present invention relates to an immunogenic composition comprising: a) a modified live H3 virus of swine influenza, and b) a modified live H1 virus of swine influenza. Furthermore, the present invention relates to methods for immunizing a subject comprising administering to such subject the immunogenic composition of the present invention. Moreover, the present invention relates to methods of treating or preventing clinical signs caused by swine influenza virus in a subject of need, the method comprising administering to the subject a therapeutically effective amount of an immunogenic composition according to the present invention.

**Type:** Grant**Filed:** June 22, 2018**Date of Patent:** February 2, 2021**Inventors:** Marc Allan Eichmeyer, Wesley Scott Johnson, Eric Martin Vaughn, Michelle L. Walz**Adjuvant for vaccines, vaccine, and immunity induction method****Patent number:** 10857228

**Abstract:** The present invention provides an adjuvant for vaccine including a Dectin-1 ligand and a TLR agonist, a vaccine including the adjuvant for vaccine and at least one antigen, and the like.

**Type:** Grant

**Filed:** June 10, 2016

**Date of Patent:** December 8, 2020

**Assignee:** The University of Tokyo

**Inventors:** Satoshi Uematsu, Naoki Takemura

**Bivalent swine influenza virus vaccine**

**Patent number:** 10772950

**Abstract:** The present invention relates to an immunogenic composition comprising: a) a modified live H3 virus of swine influenza, and b) a modified live H1 virus of swine influenza. Furthermore, the present invention relates to methods for immunizing a subject comprising administering to such subject the immunogenic composition of the present invention. Moreover, the present invention relates to methods of treating or preventing clinical signs caused by swine influenza virus in a subject of need, the method comprising administering to the subject a therapeutically effective amount of an immunogenic composition according to the present invention.

**Type:** Grant

**Filed:** June 22, 2018

**Date of Patent:** September 15, 2020

**Inventors:** Marc Allan Eichmeyer, Wesley Scott Johnson, Eric Martin Vaughn, Michelle L. Walz

**Methods for inducing an immune response**

**Patent number:** 10624961

**Abstract:** Methods and uses are provided for inducing an immune response comprising at least two administrations of an immunogenic composition, wherein a lower dose is given in the second administration than in the first administration, and wherein the second administration may be unadjuvanted.

**Type:** Grant

**Filed:** April 2, 2015

**Date of Patent:** April 21, 2020

**Assignee:** GLAXOSMITHKLINE BIOLOGICALS SA

**Inventors:** William Ripley Ballou, Jr., Arnaud Michel Didierlaurent, Robbert Gerrit Van Der Most

**Probiotic compositions and methods of use**

**Patent number:** 10596206

**Abstract:** Provided herein are probiotic compositions and methods to enhance bacterial diversity in the intestinal tract of a subject. A probiotic is provided comprising lymphoid tissue-resident commensal bacteria, and optionally IL-10, IL-22, and/or hepcidin. The probiotic can be used to promote intestinal health or to treat or prevent intestinal disease or condition.

**Type:** Grant

**Filed:** March 14, 2018

**Date of Patent:** March 24, 2020

**Assignee:** Cornell University

**Inventors:** Gregory F. Sonnenberg, Nicholas J. Bessman

#### **Computationally optimized broadly reactive antigens for H1N1 influenza**

**Patent number:** 10562940

**Abstract:** Described herein is the generation of optimized H1N1 influenza HA polypeptides for eliciting a broadly reactive immune response to H1N1 influenza virus isolates. The optimized HA polypeptides were developed through a series of HA protein alignments, and subsequent generation of consensus sequences, based on selected H1N1 viruses isolated from 1918-2011. Provided herein are optimized H1N1 HA polypeptides, and compositions, fusion proteins and VLPs comprising the HA polypeptides. Further provided are codon-optimized nucleic acid sequences encoding the HA polypeptides. Methods of eliciting an immune response against influenza virus in a subject are also provided by the present disclosure.

**Type:** Grant

**Filed:** August 31, 2018

**Date of Patent:** February 18, 2020

**Assignee:** University of Pittsburgh— Of the Commonwealth System of Higher Education

**Inventors:** Ted M. Ross, Corey J. Crevar

#### **Inactivated equine influenza virus vaccines**

**Patent number:** 10555998

**Abstract:** The present invention relates to equine influenza virus (EIV) isolates that when administered in vaccines to equine provide protection against currently emerging EIV strains in the U.S. The present invention also relates to inactivated EIV isolates. In addition, the present invention also relates to safe and efficacious vaccines that comprise the EIV isolates, as well as to corresponding subunit vaccines. The present invention further relates to methods of administering such safe and efficacious vaccines to equine.

**Type:** Grant

**Filed:** November 23, 2015

**Date of Patent:** February 11, 2020

**Assignee:** Intervet Inc.

**Inventors:** Zhisong Qiao, Catherine M. Peters, Zhuyan Guo, Wendy Vaala, Craig Barnett

**Circulation of components during microfluidization and/or homogenization of emulsions**

**Patent number:** 10463615

**Abstract:** An improved method for the manufacture of an oil-in-water emulsion involves circulation of emulsion components between a first container and a second container via a homogenizer and/or via a microfluidization device. Usefully, all of the emulsion components from the first container are emptied before being returned.

**Type:** Grant

**Filed:** June 26, 2017

**Date of Patent:** November 5, 2019

**Assignee:** NOVARTIS AG

**Inventors:** Harald Rueckl, Hanno Scheffczik, Barbara Santry

**H3 influenza A virus**

**Patent number:** 10369212

**Abstract:** The invention provides an isolated H3 equine influenza A virus, as well as methods of preparing and using the virus, and genes or proteins thereof.

**Type:** Grant

**Filed:** June 22, 2018

**Date of Patent:** August 6, 2019

**Assignee:** Wisconsin Alumni Research Foundation (WARF)

**Inventors:** Christopher W. Olsen, Gabriele A. Landolt, Alexander I. Karasin

**Newcastle disease virus vectored avian vaccines**

**Patent number:** 10350286

**Abstract:** The present invention encompasses engineered Newcastle Disease Virus (NDV) vaccines or compositions. The vaccine or composition may be a recombinant vaccine. The invention also encompasses recombinant vectors encoding and expressing avian pathogen antigens, more specifically avian influenza proteins, epitopes or immunogens. Such vaccines or compositions can be used to protect animals, in particular avian, against disease.

**Type:** Grant

**Filed:** February 16, 2017

**Date of Patent:** July 16, 2019

**Assignee:** BOEHRINGER INGELHEIM ANIMAL HEALTH USA INC.

**Inventors:** Michel Bublot, Frederic Reynard, François-Xavier Le Gros

**Hemagglutinin polypeptides, and reagents and methods relating thereto**

**Patent number:** 10226527

**Abstract:** The present invention provides a system for analyzing interactions between glycans and interaction partners that bind to them. The present invention also provides HA polypeptides that bind to umbrella-topology glycans, and reagents and methods relating thereto.

**Type:** Grant

**Filed:** October 4, 2011

**Date of Patent:** March 12, 2019

**Assignee:** MASSACHUSETTS INSTITUTE OF TECHNOLOGY

**Inventors:** Kannan Tharakaraman, Karthik Viswanathan, Rahul Raman, Ram Sasisekharan

**Methods and compositions for inactivating enveloped viruses**

**Patent number:** 10188732

**Abstract:** Aspects of the invention provide therapeutic recombinant protein preparations and methods of preparing therapeutic recombinant protein, which methods include contacting recombinant protein preparations with zwitterionic detergent at or above critical micelle concentration of the detergent.

**Type:** Grant

**Filed:** August 6, 2013

**Date of Patent:** January 29, 2019

**Assignee:** Biogen MA Inc.

**Inventors:** Lynn Edward Conley, Yinying Tao

**Influenza virus vector for virotherapy**

**Patent number:** 10125374

**Abstract:** The present invention provides a recombinant influenza virus vector comprising an NS gene encoding a truncated NS1 protein of at least 73 and up to 122 amino acids of the N-terminus of the respective wild type NS 1 protein, wherein said vector replicates in IFN-



sensitive tumor cells and does not replicate in normal, non-tumor cells, and expresses a heterologous immunostimulatory polypeptide. The invention further provides a pharmaceutical composition containing said influenza virus vector, its use for the treatment of cancer patients and methods for producing said influenza virus vaccine.

**Type:** Grant

**Filed:** October 28, 2014

**Date of Patent:** November 13, 2018

**Assignee:** BLUE SKY VACCINES GMBH

**Inventor:** Thomas Muster

**Liposome compositions comprising an adjuvant that activates or increases the activity of TLR2 and uses thereof**

**Patent number:** 10105435

**Abstract:** The invention provides compositions comprising liposomes, an antigen capable of inducing a humoral immune response, a carrier comprising a continuous phase of a hydrophobic substance, and an adjuvant that activates or increases the activity of TLR2. The invention also provides uses for such compositions in inducing a humoral response and methods for their use in the treatment of a disease, disorder or ailment ameliorated by a humoral immune response.

**Type:** Grant

**Filed:** October 5, 2012

**Date of Patent:** October 23, 2018

**Assignee:** IMMUNOVACCINE TECHNOLOGIES INC.

**Inventors:** Marc Mansour, Lisa Diana MacDonald, Genevieve Mary Weir, Leeladhar Sammatur, Kendall Sharp

**H3 influenza A virus**

**Patent number:** 10034932

**Abstract:** The invention provides an isolated H3 equine influenza A virus, as well as methods of preparing and using the virus, and genes or proteins thereof.

**Type:** Grant

**Filed:** October 5, 2017

**Date of Patent:** July 31, 2018

**Assignee:** Wisconsin Alumni Research Foundation (WARF)

**Inventors:** Christopher W. Olsen, Gabriele A. Landolt, Alexander I. Karasin

**Influenza virus reassortment**

**Patent number:** 10030231

**Abstract:** Improved methods for the production of reassortant influenza viruses are provided.

**Type:** Grant

**Filed:** January 23, 2014

**Date of Patent:** July 24, 2018

**Assignees:** Seqirus UK Limited, Synthetic Genomics Vaccines, Inc.

**Inventors:** Philip Dormitzer, Peter Mason, Pirada Suphaphiphat, Daniel Gibson, David Wentworth, Timothy Stockwell, John Glass

#### **Bivalent swine influenza virus vaccine**

**Patent number:** 10029005

**Abstract:** The present invention relates to an immunogenic composition comprising: a) a modified live H3 virus of swine influenza, and b) a modified live H1 virus of swine influenza. Furthermore, the present invention relates to methods for immunizing a subject comprising administering to such subject the immunogenic composition of the present invention. Moreover, the present invention relates to methods of treating or preventing clinical signs caused by swine influenza virus in a subject of need, the method comprising administering to the subject a therapeutically effective amount of an immunogenic composition according to the present invention.

**Type:** Grant

**Filed:** February 23, 2016

**Date of Patent:** July 24, 2018

**Assignee:** Boehringer Ingelheim Vetmedica GmbH

**Inventors:** Marc Allan Eichmeyer, Wesley Scott Johnson, Eric Martin Vaughn, Michelle L. Walz

#### **Production of infectious influenza viruses**

**Patent number:** 9982240

**Abstract:** The invention relates to a method for producing influenza infectious viruses wherein CHO cells are infected with a seed of infectious influenza virus which has been generated by transfecting cells with an appropriate set of expression vectors. The invention also relates to a recombination cassette, and to a vector comprising said recombination cassette, that may be used in methods for producing infectious viruses, and particularly in the method according to the invention.

**Type:** Grant

**Filed:** July 29, 2013

**Date of Patent:** May 29, 2018

**Assignee:** Sanofi Pasteur

**Inventors:** Isabelle Legastelois, Julie Medina, Catherine Moste

**Adjuvant-sparing multi-dose influenza vaccination regimen**

**Patent number:** 9901630

**Abstract:** An influenza vaccine is administered by a multi-dose regimen, in which (i) a first dose is administered with an adjuvant and (ii) a later dose is administered either without an adjuvant or with a different adjuvant. Thus the invention provides the benefits of a two-dose regimen without also doubling the supply need for a given adjuvant.

**Type:** Grant

**Filed:** July 8, 2014

**Date of Patent:** February 27, 2018

**Assignee:** Seqirus UK Limited

**Inventors:** Giuseppe Del Giudice, Riccardo Manetti

**Attenuated influenza vaccines and uses thereof**

**Patent number:** 9878032

**Abstract:** Provided herein are attenuated influenza viruses and methods of making attenuated influenza viruses.

**Type:** Grant

**Filed:** July 18, 2014

**Date of Patent:** January 30, 2018

**Assignee:** UNIVERSITY OF ROCHESTER

**Inventors:** Andrew Cox, Stephen Dewhurst, John Treanor, Baek Kim

**Adjuvanted vaccine formulations**

**Patent number:** 9878034

**Abstract:** The invention relates to adjuvanted vaccine formulations, in particular influenza vaccines for intranasal delivery. Provided is an adjuvanted influenza vaccine formulation, comprising (i) peptidoglycan microparticles obtained from a Gram-positive bacterium and (ii) at least one influenza virus antigen or antigenic preparation thereof, which antigen or antigenic preparation is not fused or otherwise covalently attached to a proteinaceous peptidoglycan binding moiety.

**Type:** Grant

**Filed:** October 1, 2010

**Date of Patent:** January 30, 2018

**Assignee:** MUCOSIS B.V.

**Inventors:** Govert Johan Schouten, Cornelis Johannes Leenhouts

#### **Nucleic acid vaccines**

**Patent number:** 9872900

**Abstract:** The invention relates to compositions and methods for the preparation, manufacture and therapeutic use ribonucleic acid vaccines (NAVs) comprising polynucleotide molecules encoding one or more antigens.

**Type:** Grant

**Filed:** April 5, 2016

**Date of Patent:** January 23, 2018

**Assignee:** ModernaTX, Inc.

**Inventors:** Giuseppe Ciaramella, Axel Bouchon, Eric Yi-Chun Huang

#### **Intradermal delivery of immunological compositions comprising toll-like receptor 7 agonists**

**Patent number:** 9827190

**Abstract:** An intradermal delivery system comprises an immunogenic composition comprising a TLR agonist and immunogen and a microneedle. The immunogenic composition may comprise a solid biodegradable microneedle or a solid coated microneedle. The intradermal delivery system may be formulated into a skin patch.

**Type:** Grant

**Filed:** January 30, 2014

**Date of Patent:** November 28, 2017

**Assignee:** GLAXOSMITHKLINE BIOLOGICALS SA

**Inventors:** Barbara Baudner, Simona Gallorini, Derek O'Hagan

#### **H3 influenza A virus**

**Patent number:** 9814770

**Abstract:** The invention provides an isolated H3 equine influenza A virus, as well as methods of preparing and using the virus, and genes or proteins thereof.

**Type:** Grant

**Filed:** November 2, 2016

**Date of Patent:** November 14, 2017

**Assignee:** Wisconsin Alumni Research Foundation

**Inventors:** Christopher W. Olsen, Gabriele A. Landolt, Alexander I. Karasin

**Subunit vaccine delivery platform for robust humoral and cellular immune responses**

**Patent number:** 9808517

**Abstract:** The present invention relates to a probiotic cell transformed with a construct suitable to overexpress and display on the surface of the probiotic cell a fusion protein comprising at least a portion of a transport protein coupled to at least a portion of one or more antigenic proteins or peptides. Probiotic-derived vesicles displaying this fusion protein as well as methods of inducing an immune response using the probiotic cells or vesicles are also disclosed.

**Type:** Grant

**Filed:** March 13, 2013

**Date of Patent:** November 7, 2017

**Assignee:** Cornell University

**Inventors:** David Putnam, Joseph Rosenthal, Chung-Jr Huang, Matthew Delisa, Susana Mendez

**Influenza virus**

**Patent number:** 9771564

**Abstract:** The present invention provides a novel influenza virus wherein both the NS and the PB1 gene segments are modified and wherein the PB1-F2 open reading frame is modified by introduction of at least one stop codon. Specifically, the influenza virus is lacking functional NS1 and PB1-F2 proteins. Additionally, a vaccine formulation comprising the modified influenza virus is provided and its use for prevention of influenza vaccination.

**Type:** Grant

**Filed:** July 20, 2010

**Date of Patent:** September 26, 2017

**Assignee:** NANOTHERAPEUTICS, INC.

**Inventors:** Thomas Muster, Ekaterina Romanovskaya-Romanko, Oleg Kiselev, Markus Wolschek, Boris Ferko, Andrej Egorov

**Exogenous internal positive control**

**Patent number:** 9580761

**Abstract:** The present invention provides an internal positive control for contaminating viruses. The invention provides the use of a second virus as an exogenous internal positive control in methods for verifying the reliability of an assay to detect a first virus, in methods

of ensuring the absence of the first virus in a biological sample or pharmaceutical sample and in methods of manufacturing a vaccine free from a first virus.

**Type:** Grant

**Filed:** February 24, 2012

**Date of Patent:** February 28, 2017

**Assignee:** Novartis AG

**Inventor:** Bernhard Roth

#### **Methods for producing yeast-based vaccines**

**Patent number:** 9549970

**Abstract:** The invention provides methods for culturing yeast at a neutral pH level. Yeast cultured under neutral pH conditions exhibit desirable characteristics useful for biological purposes, such as the development of vaccines, prophylactics and therapeutics. The invention also provides for compositions and kits comprising yeast grown using the methodologies disclosed herein.

**Type:** Grant

**Filed:** March 13, 2013

**Date of Patent:** January 24, 2017

**Assignee:** GlobeImmune, Inc.

**Inventors:** Alex Franzusoff, Deborah Quick

#### **Genetically engineered swine influenza virus and uses thereof**

**Patent number:** 9549975

**Abstract:** The present invention relates, in general, to attenuated swine influenza viruses having an impaired ability to antagonize the cellular interferon (IFN) response, and the use of such attenuated viruses in vaccine and pharmaceutical formulations. In particular, the invention relates to attenuated swine influenza viruses having modifications to a swine NS1 gene that diminish or eliminate the ability of the NS1 gene product to antagonize the cellular IFN response. These viruses replicate in vivo, but demonstrate decreased replication, virulence and increased attenuation, and therefore are well suited for use in live virus vaccines, and pharmaceutical formulations.

**Type:** Grant

**Filed:** March 3, 2015

**Date of Patent:** January 24, 2017

**Assignees:** Icahn School of Medicine at Mount Sinai, St. Jude Children's Research Hospital, The United States of America, as Represented by the Secretary of Agriculture

**Inventors:** Peter Palese, Adolfo Garcia-Sastre, Richard J. Webby, Juergen A. Richt, Robert G. Webster, Kelly M. Lager

**Processing biological material for flow cytometry evaluation for virus particles**

**Patent number:** 9546936

**Abstract:** In a method for processing biological materials for flow cytometry evaluation for virus particles, a mixture including biological material and purification particles is centrifuged to prepare a centrifuged composition including a supernatant that may be further processed prior to the flow cytometry evaluation. The purification particles include porous cores functionalized to capture smaller-size impurities in a biological material sample and a porous size-exclusion shell surrounding the core to exclude larger-size components of the biological material from entering into the core. Multiple samples may be processed in multi-sample processing units. A product may contain a sealed container with the unit quantity of purification particle in a storage liquid and a kit may include such a sealed container and a centrifugal filter.

**Type:** Grant

**Filed:** November 20, 2015

**Date of Patent:** January 17, 2017

**Assignee:** VIROCYT, INC.

**Inventors:** Kathy L. Rowlen, Erica Dawson Tenent, Lauren R. Wolfe

**H3 influenza a virus**

**Patent number:** 9492530

**Abstract:** The invention provides an isolated H3 equine influenza A virus, as well as methods of preparing and using the virus, and genes or proteins thereof.

**Type:** Grant

**Filed:** August 31, 2015

**Date of Patent:** November 15, 2016

**Assignee:** Wisconsin Alumni Research Foundation

**Inventors:** Christopher W. Olsen, Gabriele A. Landolt, Alexander I. Karasin

**Attenuated negative strand viruses with altered interferon antagonist activity for use as vaccines and pharmaceuticals**

**Patent number:** 9387240

**Abstract:** The present invention relates, in general, to attenuated negative-strand RNA viruses having an impaired ability to antagonize the cellular interferon (IFN) response, and the use of such attenuated viruses in vaccine and pharmaceutical formulations. The

invention also relates to the development and use of IFN-deficient systems for selection of such attenuated viruses. In particular, the invention relates to attenuated influenza viruses having modifications to the NS1 gene that diminish or eliminate the ability of the NS1 gene product to antagonize the cellular IFN response. The mutant viruses replicate in vivo but demonstrate reduced pathogenicity, and therefore are well suited for live virus vaccines, and pharmaceutical formulations.

**Type:** Grant

**Filed:** May 22, 2014

**Date of Patent:** July 12, 2016

**Assignee:** Icahn School of Medicine at Mount Sinai

**Inventors:** Peter Palese, Adolfo Garcia-Sastre, Thomas Muster

#### **Materials and methods for respiratory disease control in canines**

**Patent number:** 9345758

**Abstract:** The subject invention pertains to isolated influenza virus that is capable of infecting canids and causing respiratory disease in the canid. The subject invention also pertains to compositions and methods for inducing an immune response against an influenza virus of the present invention. The subject invention also pertains to compositions and methods for identifying a virus of the invention and diagnosing infection of an animal with a virus of the invention.

**Type:** Grant

**Filed:** April 19, 2011

**Date of Patent:** May 24, 2016

**Assignees:** University of Florida Research Foundation, Inc., The United States of America as represented by The Secretary of The Department of Health and Human Services, Centers for Disease Control and Prevention, Cornell Research Foundation, Inc.

**Inventors:** Patti C. Crawford, Paul J. Gibbs, Edward J. Dubovi, Ruben Omar Donis, Jacqueline Katz, Alexander I. Klimov, Nallakannu P. Lakshmanan, Melissa Anne Lum, Daniel Ghislina Emiel Goovaerts, Mark William Mellencamp, William L. Castleman, Nancy J. Cox

#### **Peptidic activators of type I cGMP dependent protein kinases and uses thereof**

**Patent number:** 9260486

**Abstract:** The present invention relates to cGMP protein kinase (PKG) and regulatory domains and methods of use thereof. The structural determination of PKG domains is also described. cGMP independent PKG activators and uses thereof are also described.

**Type:** Grant



**Filed:** March 13, 2013

**Date of Patent:** February 16, 2016

**Assignee:** The University of Vermont and State Agricultural College

**Inventors:** Wolfgang Dostmann, Brent W. Osborne, Thomas M. Moon

**Systems and methods for identifying replikin scaffolds and uses of said replikin scaffolds**

**Patent number:** 9254315

**Abstract:** The present invention provides a new class of peptides related to rapid replication and high human mortality, and their use in diagnosing, preventing and treating disease including vaccines and therapeutics for emerging viral diseases and methods of identifying the new class of peptides and related structures.

**Type:** Grant

**Filed:** February 3, 2010

**Date of Patent:** February 9, 2016

**Inventors:** Samuel Bogoch, Elenore S. Bogoch, Samuel Winston Bogoch, Anne Elenore Borsanyi

**Influenza nucleic acid molecules and vaccines made therefrom**

**Patent number:** 9192660

**Abstract:** Provided herein are nucleic acid sequences that encode novel consensus amino acid sequences of HA hemagglutinin, as well as genetic constructs/vectors and vaccines expressing the sequences. Also provided herein are methods for generating an immune response against one or more Influenza A serotypes using the vaccines that are provided.

**Type:** Grant

**Filed:** October 26, 2012

**Date of Patent:** November 24, 2015

**Assignee:** The Trustees of the University of Pennsylvania

**Inventors:** David B Weiner, Matthew P Morrow, Jian Yan

**Recombinant modified vaccinia virus Ankara influenza vaccine**

**Patent number:** 9173933

**Abstract:** The invention concerns a recombinant modified vaccinia virus Ankara (MVA virus) expressing at least two external influenza virus antigens and/or an epitope of one or more of the at least two antigens and at least two internal influenza virus antigens and/or an epitope of the at least two antigens. The invention, thus, concerns a recombinant MVA virus encoding multiple external and/or internal influenza virus antigens, preferably from

multiple influenza virus strains. The invention further concerns the use of said recombinant MVA in preparing a medicament and vaccine for influenza virus. Further encompassed by the present invention are methods, composition and kits.

**Type:** Grant

**Filed:** October 7, 2011

**Date of Patent:** November 3, 2015

**Assignee:** BAVARIAN NORDIC A/S

**Inventors:** Josef Weigl, Jürgen Hausmann, Robin Steigerwald

**Single expression vector for generation of a virus with a segmented genome**

**Patent number:** 9163219

**Abstract:** The present invention encompasses an expression vector that is capable of generating a virus from a segmented genome. In particular, a single expression vector may be utilized to produce influenza virus in cultured cells. The expression vector can be delivered in a purified DNA form or by a suitably designed bacterial carrier to cells in culture or to animals. This invention increases the virus generation efficiency, which benefits vaccine development. The bacterial carrier harboring such a plasmid encoding an attenuated virus may be used as a vaccine against corresponding viral disease.

**Type:** Grant

**Filed:** April 14, 2010

**Date of Patent:** October 20, 2015

**Assignee:** Arizona Board of Regents on behalf of Arizona State University

**Inventors:** Roy Curtiss, III, Xiangmin Zhang

**Nanoemulsion influenza vaccine**

**Patent number:** 9144606

**Abstract:** The present invention relates to methods for inducing an immune response to influenza in a subject comprising administering a nanoemulsion vaccine composition comprising an influenza immunogen or protein.

**Type:** Grant

**Filed:** April 21, 2009

**Date of Patent:** September 29, 2015

**Assignee:** NanoBio Corporation

**Inventors:** James R. Baker, Jr., Tarek Hamouda, Joyce A. Sutcliffe

**Influenza hemagglutinin and neuraminidase variants**

**Patent number:** 9028838

**Abstract:** Polypeptides, polynucleotides, methods, compositions, and vaccines comprising (avian pandemic) influenza hemagglutinin and neuraminidase variants are provided.

**Type:** Grant

**Filed:** March 4, 2013

**Date of Patent:** May 12, 2015

**Assignee:** MedImmune, LLC

**Inventors:** Chin-Fen Yang, George Kemble

**Microneedle device, and method for enhancing the efficacy of influenza vaccine by using microneedle device**

**Patent number:** 9028463

**Abstract:** The present invention provides a method for enhancing the immunogenicity using a microneedle device capable of enhancing the immunogenicity of an influenza vaccine. According to the method for enhancing the immunogenicity using the present microneedle device, a microneedle device having microneedles made of polylactic acid, coated with an influenza vaccine composed of an antigen having type A strain (H1N1), type A strain (H3N2), and type B strain as active ingredients is brought into direct contact with the skin so as to transcutaneously administer the aforementioned influenza vaccine. After the transcutaneous administration, lauryl alcohol is applied to the site of the skin where the microneedle device has been brought into direct contact.

**Type:** Grant

**Filed:** May 22, 2009

**Date of Patent:** May 12, 2015

**Assignees:** Hisamitsu Pharmaceutical Co., Inc., The Chemo-Sero-Therapeutic Research Institute

**Inventors:** Chikateru Nozaki, Kazuyoshi Kaminaka, Junichi Matsuda, Takaaki Terahara, Tetsuji Kuwahara, Seiji Tokumoto

**Swine influenza hemagglutinin variants**

**Patent number:** 9017694

**Abstract:** The technology relates in part to modified influenza viruses useful for vaccine development. Polypeptides, polynucleotides, methods, compositions, and vaccines comprising influenza hemagglutinin and neuraminidase variants are provided.

**Type:** Grant

**Filed:** October 4, 2012

**Date of Patent:** April 28, 2015

**Assignee:** MedImmune, LLC

**Inventors:** Hong Jin, Zhongying Chen

**Canine influenza virus and related compositions and methods of use**

**Patent number:** RE45564

**Abstract:** The present invention provides an isolated canine influenza virus of subtype H3N8 comprising an HA having SEQ ID NO: 4 or an amino acid sequence that is greater than 99% identical to SEQ ID NO: 4, with the proviso that the amino acids at positions 94 and 233 are identical to SEQ ID NO: 4; a composition comprising attenuated or inactivated virus; isolated or purified HA, NM, NP, M1, NS1, PA, PB1, and PB2 proteins and fragments thereof and compositions comprising same or nucleic acids, optionally as part of a vector, encoding same; and a method of inducing an immune response to canine influenza virus in an animal comprising administering to the animal an aforementioned composition.

**Type:** Grant

**Filed:** November 8, 2013

**Date of Patent:** June 16, 2015

**Assignee:** IOWA STATE UNIVERSITY RESEARCH FOUNDATION, INC.

**Inventors:** Kyoung-Jin Yoon, Vickie Cooper

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