1. A replication-deficient pseudoinfectious flavivirus comprising a yellow fever or West Nile virus genome comprising (i) one or more deletions in nucleotide sequences encoding amino acids 20 to 100 of capsid (C) protein, and one or more deletions within nucleotide sequences encoding a pre-membrane (prM) and/or envelope (E) protein, and (ii) a sequence encoding one or more heterologous pathogen immunogens inserted in the place of or in combination with the one or more deletions of the pre-membrane (prM) and/or envelope (E) protein,

wherein said pathogen is selected from the group consisting of a rabies virus, *Borrelia burgdorferi*, an influenza virus, a human immunodeficiency virus, a simian immunodeficiency virus, a human papilloma virus, a respiratory syncytial virus, a malaria parasite, and *Mycobacterium tuberculosis.*

2. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said heterologous pathogen immunogen comprises a rabies virus G protein immunogen or an immunogenic fragment thereof.

3. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said heterologous pathogen immunogen comprises *Borrelia burgdorferi* OspA immunogen or an immunogenic fragment thereof.

4. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said heterologous pathogen immunogen comprises an influenza virus hemaglutinnin (HA) or an immunogenic fragment thereof.

5. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said heterologous pathogen immunogen comprises a codon-optimized HIV gag protein or an immunogenic fragment thereof.

6. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said heterologous pathogen immunogen comprises an HPV16 capsid protein or an immunogenic fragment thereof.

7. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said heterologous pathogen immunogen comprises a respiratory syncytial virus F glycoprotein.

8. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said flavivirus genome comprises sequences encoding a pre-membrane (prM) and/or envelope (E) protein.

9 The replication-deficient pseudoinfectious flavivirus of claim 1, wherein the flavivirus genome is

a chimera comprising pre-membrane (prM) and envelope (E) sequences of a first flavivirus, and capsid (C) and non-structural sequences of a second, different flavivirus.

10. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said yellow fever or West Nile virus genome is packaged in a particle comprising capsid (C), pre-membrane (prM) and/or envelope (E) amino acid sequences from a flavivirus that is the same or different from that of the genome.

11. A pharmaceutical composition comprising the replication-deficient pseudoinfectious flavivirus of claim 1 and a pharmaceutically acceptable carrier or diluent.

12. The pharmaceutical composition of claim 11 for use in inducing an immune response against the heterologous pathogen immunogen in a subject.

13. The pharmaceutical composition of claim 11 for use in inducing an immune response against the heterologous pathogen immunogen in a subject wherein the subject is at risk of but does not have an infection by said pathogen.

14. The pharmaceutical composition of claim 11 for use in inducing an immune response against the heterologous pathogen immunogen in a subject wherein the subject has an infection by said pathogen.

15. The pharmaceutical composition of claim 11, further comprising an adjuvant.

16. A nucleic acid molecule corresponding to the genome of a pseudoinfectious flavivirus of claim 1.

17. A method of making a replication-deficient pseudoinfectious flavivirus of claim 1, the method comprising introducing a nucleic acid molecule of claim 16 into a cell that expresses the protein corresponding to any sequences deleted from the flavivirus genome of the replication-deficient pseudoinfectious flavivirus.

18. The method of claim 17, wherein the protein is expressed in the cell from the genome of a second, different, replication-deficient pseudoinfectious flavivirus.

19. The method of claim 17, wherein the protein is expressed from a replicon.

20. The method of claim 19, wherein the replicon is an alphavirus replicon.

21. The method of claim 20, wherein the alphavirus is a Venezuelan Equine Encephalitis virus.

22. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said heterologous pathogen immunogen comprises an influenza virus M2 epitope or an immunogenic fragment thereof.

23. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said heterologous pathogen immunogen comprises an influenza virus neuraminidase (NA) epitope or an immunogenic fragment thereof.

24. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said heterologous pathogen immunogen comprises a codon-optimized HIV gp120 protein or an immunogenic fragment thereof.

25. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said heterologous pathogen immunogen comprises a codon-optimized HIV tat/nef protein or an immunogenic fragment thereof.

26. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said heterologous pathogen immunogen comprises an HPV18 capsid protein or an immunogenic fragment thereof.

27. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said heterologous pathogen immunogen comprises a respiratory syncytial virus G glycoprotein.

1. A replication-deficient pseudoinfectious flavivirus comprising a flavivirus genome comprising (i) one or more deletions or mutations in nucleotide sequences encoding one or more proteins selected from the group consisting of capsid (C), pre-membrane (prM), envelope (E), non-structural protein 1 (NS1), non-structural protein 3 (NS3), and non-structural protein 5 (NS5), and (ii) a sequence encoding one or more heterologous pathogen, cancer, or allergy-related immunogens.

2. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said one or more deletions or mutations is within capsid (C) sequences of the flavivirus genome.

3. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said one or more deletions or mutations is within pre-membrane (prM) and/or envelope (E) sequences of the flavivirus genome.

4. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said one or more deletions or mutations is within capsid (C), pre-membrane (prM), and envelope (E) sequences of the flavivirus genome.

5. The replication-deficient pseudoinfectious flavivirus of claim 1, wherein said one or more deletions or mutations is within non-structural protein 1 (NS1) sequences of the flavivirus genome.

6. The replication-deficient pseudoinfectious flavivirus of any of claims 1-5, wherein said heterologous immunogen is from a pathogen selected from the group consisting of a rabies virus, *Borrelia burgdorferi*, a tick, an influenza virus, a human immunodeficiency virus, a simian immunodeficiency virus, a human papilloma virus, a respiratory syncytial virus, malaria parasite, and *Mycobacterium tuberculosis*.

7. The replication-deficient pseudoinfectious flavivirus of claim 6, wherein said heterologous immunogen comprises a rabies virus G protein immunogen or an immunogenic fragment thereof.

8. The replication-deficient pseudoinfectious flavivirus of claim 6, wherein said heterologous immunogen comprises *Borrelia burgdorferi* OspA immunogen or an immunogenic fragment thereof.

9. The replication-deficient pseudoinfectious flavivirus of claim 6, wherein said heterologous immunogen comprises a tick saliva protein selected from the group consisting of 64TRP, Isac, and Salp20, or an immunogenic fragment thereof.

10. The replication-deficient pseudoinfectious flavivirus of claim 6, wherein said heterologous immunogen comprises an influenza virus M2, hemaglutinnin (HA), or neuraminidase (NA) epitope, or an immunogenic fragment thereof.

11. The replication-deficient pseudoinfectious flavivirus of claim 6, wherein said heterologous immunogen comprises a codon-optimized HIV gag, tat/nef, or gp120 protein, or an immunogenic fragment thereof.

12. The replication-deficient pseudoinfectious flavivirus of claim 6, wherein said heterologous immunogen comprises an HPV16 or HPV18 capsid protein L1 or L2, or an immunogenic fragment thereof.

13. The replication-deficient pseudoinfectious flavivirus of claim 6, wherein said heterologous immunogen comprises a respiratory syncytial virus F or G glycoprotein.

14. The replication-deficient pseudoinfectious flavivirus of any of claims 1-13, wherein said flavivirus genome comprises sequences encoding a pre-membrane (prM) and/or envelope (E) protein.

15. The replication-deficient pseudoinfectious flavivirus of any of claims 1-14, wherein the flavivirus genome is selected from that of yellow fever virus, West Nile virus, tick-borne encephalitis virus, Langat virus, Japanese encephalitis virus, dengue virus, and St. Louis encephalitis virus sequences, and chimeras thereof.

16. The replication-deficient pseudoinfectious flavivirus of claim 15, wherein said chimera comprises pre-membrane (prM) and envelope (E) sequences of a first flavivirus, and capsid (C) and non-structural sequences of a second, different flavivirus.

17. The replication-deficient pseudoinfectious flavivirus of claim 16, wherein said first flavivirus is a tick-borne encephalitis virus or a Langat virus.

18. The replication-deficient pseudoinfectious flavivirus of claim 16 or 17, wherein said second, different flavivirus is a yellow fever virus or a West Nile virus or Langat virus.

19. The replication-deficient pseudoinfectious flavivirus of any of claims 1-18, wherein said genome is packaged in a particle comprising pre-membrane (prM) and envelope (E) sequences from a flavivirus that is the same or different from that of the genome.

20. The replication-deficient pseudoinfectious flavivirus of any of claims 1-19, wherein sequences encoding said heterologous immunogen are inserted in the place of or in combination with the one or more deletions or mutations of the one or more proteins.

21. The replication-deficient pseudoinfectious flavivirus of any of claims 1-20, wherein sequences encoding said heterologous immunogen are inserted in the flavivirus genome within sequences encoding the envelope (E) protein, within sequences encoding the non-structural 1 (NS1) protein, within sequences encoding the pre-membrane (prM) protein, intergenically between sequences encoding the envelope (E) protein and non-

structural protein 1 (NS1), intergenically between non-structural protein 2B (NS2B) and non-structural protein 3 (NS3), or as a bicistronic insertion in the 3' untranslated region of the flavivirus genome.

22. A composition comprising a first replication-deficient pseudoinfectious flavivirus of any of claims 1-21 and a second, different replication-deficient pseudoinfectious flavivirus comprising a genome comprising one or more deletions or mutations in nucleotide sequences encoding one or more proteins selected from the group consisting of capsid (C), pre-membrane (prM), envelope (E), non-structural protein 1 (NS1), non-structural protein 3 (NS3), and non-structural protein 5 (NS5), wherein the one or more proteins encoded by the sequences in which the one or more deletion(s) or mutation(s) occur in the second, different replication-deficient pseudoinfectious flavivirus are different from the one or more proteins encoded by the sequences in which the one or more deletion(s) or mutation(s) occur in the first replication-deficient pseudoinfectious flavivirus.

23. A method of inducing an immune response to an immunogen in a subject, the method comprising administering to the subject one or more replication-deficient pseudoinfectious flaviviruses of any of claims 1-21 and/or a composition of claim 22 to the subject.

24. The method of claim 23, wherein the subject is at risk of but does not have an infection by said pathogen or a disease or condition associated with said cancer or allergy-related immunogen.

25. The method of claim 23, wherein the subject has an infection by said pathogen or a disease or condition associated with said cancer or allergy-related immunogen.

26. The method of any of claims 23-25, wherein the immunogen is from a pathogen selected from the group consisting of a rabies virus, *Borrelia burgdorferi*, a tick, an influenza virus, a human immunodeficiency virus, a simian immunodeficiency virus, a human papilloma virus, a respiratory syncytial virus, malaria parasite, and *Mycobacterium tuberculosis*.

27. The method of any of claims 23-26, wherein the method is for inducing an immune response against a protein encoded by the flavivirus genome, in addition to the source of the immunogen.

28. The method of claim 27, wherein the subject is at risk of but does not have an infection by the flavivirus corresponding to the genome of the pseudoinfectious flavivirus, which comprises sequences encoding a flavivirus pre-membrane and/or envelope protein.

29. The method of claim 27, wherein the subject has an infection by the flavivirus corresponding to the genome of the pseudoinfectious flavivirus which comprises sequences encoding a flavivirus pre-membrane and/or envelope protein.

30. A live, attenuated chimeric flavivirus comprising a yellow fever virus in which sequences encoding pre-membrane and envelope proteins are replaced with sequences encoding pre-membrane and envelope proteins of a tick-borne encephalitis virus or a Langat virus, and the signal sequence between the capsid and pre-membrane proteins of the chimeric flavivirus comprises a hybrid of yellow fever virus and tick-borne encephalitis or Langat virus capsid/pre-membrane signal sequences, or a variant thereof.

31. The live, attenuated chimeric flavivirus of claim 30, wherein the capsid/pre-membrane signal sequence of the chimeric flavivirus comprises yellow fever virus

sequences in the amino terminal region and tick-borne encephalitis or Langat virus sequences in the carboxy terminal region.

32. A live, attenuated chimeric flavivirus comprising a West Nile virus in which sequences encoding pre-membrane and envelope proteins are replaced with sequences encoding pre-membrane and envelope proteins of a tick-borne encephalitis or a Langat virus, and the signal sequence between the capsid and pre-membrane proteins of the chimeric flavivirus comprises a tick-borne encephalitis or a Langat virus capsid/pre-membrane signal sequence, or a variant thereof.

33. A pharmaceutical composition comprising a pseudoinfectious flavivirus of any of claims 1-21, the composition of claim 22, or the live, attenuated flavivirus of any of claims 30-32 and a pharmaceutically acceptable carrier or diluent.

34. The pharmaceutical composition of claim 33, further comprising an adjuvant.

35. A replication-deficient pseudoinfectious flavivirus comprising a flavivirus genome comprising one or more deletions or mutations in nucleotide sequences encoding non-structural protein 1 (NS1), non-structural protein 3 (NS3), or non-structural protein 5 (NS5).

36. A nucleic acid molecule corresponding to the genome of a pseudoinfectious flavivirus of any of claims 1-21 or 35, or the genome the live, attenuated flavivirus of any of claims 30-32.

37. A method of making a replication-deficient pseudoinfectious flavivirus of any of claims 1-21 or 35, the method comprising introducing a nucleic acid molecule of claim 36 into a cell that expresses the protein corresponding to any sequences deleted from the flavivirus genome of the replication-deficient pseudoinfectious flavivirus.

38. The method of claim 37, wherein the protein is expressed in the cell from the genome of a second, different, replication-deficient pseudoinfectious flavivirus.

39. The method of claim 37, wherein the protein is expressed from a replicon.

40. The method of claim 39, wherein the replicon is an alphavirus replicon.

41. The method of claim 40, wherein the alphavirus is a Venezuelan Equine Encephalitis virus.

42. A composition comprising two or more replication-deficient pseudoinfectious flaviviruses, wherein two of the replication-deficient pseudoinfectious flaviviruses are selected from the groups consisting of:

(a) a replication-deficient pseudoinfectious flavivirus comprising a genome comprising Japanese encephalitis virus sequences, and a replication-deficient pseudoinfectious flavivirus comprising a genome comprising dengue virus sequences;

(b) a replication-deficient pseudoinfectious flavivirus comprising a genome comprising yellow fever virus sequences, and a replication-deficient pseudoinfectious flavivirus comprising a genome comprising dengue virus sequences; and

(c) a replication-deficient pseudoinfectious flavivirus comprising a genome comprising tick-borne encephalitis or Langat virus sequences and an inserted sequence encoding a *Borrelia burgdorferi* immunogen, and a replication-deficient pseudoinfectious flavivirus comprising a genome comprising tick-borne encephalitis or Langat virus sequences and an inserted sequence encoding a tick saliva protein immunogen, or a replication-deficient pseudoinfectious flavivirus comprising a genome comprising tick-borne encephalitis or Langat virus sequences and inserted sequences encoding a *Borrelia burgdorferi* immunogen and a tick saliva protein immunogen.

43. A pharmaceutical composition comprising the live, attenuated chimeric flavivirus of any of claims 30-32.

44. A method of inducing an immune response to tick-borne encephalitis virus or Langat virus in a subject, the method comprising administering to the subject the pharmaceutical composition of claim 43.

45. The method of claim 44, wherein the subject does not have but is at risk of developing infection by tick-borne encephalitis virus or Langat virus.

46. The method of claim 44, wherein the subject is infected with tick-borne encephalitis virus or Langat virus.

47. A replication-deficient pseudoinfectious flavivirus comprising a flavivirus genome comprising one or more deletions or mutations in nucleotide sequences encoding one or more proteins selected from the group consisting of capsid (C), pre-membrane (prM), envelope (E), non-structural protein 1 (NS1), non-structural protein 3 (NS3), and non-structural protein 5 (NS5), wherein the flavivirus genome comprises yellow fever virus sequences in which sequences encoding pre-membrane and envelope proteins are replaced with sequences encoding pre-membrane and envelope proteins of a tick-borne encephalitis virus or a Langat virus, and sequences encoding the signal sequence between the capsid and pre-membrane proteins of the flavivirus genome comprise a hybrid of sequences encoding yellow fever virus and tick-borne encephalitis or Langat virus capsid/pre-membrane signal sequences, or a variant thereof.

48. The replication-deficient pseudoinfectious flavivirus of claim 47, wherein the sequences encoding the capsid/pre-membrane signal sequence of the flavivirus genome comprise yellow fever virus sequences in the 5' region and tick-borne encephalitis or Langat virus sequences in the 3' region.

49. A replication-deficient pseudoinfectious flavivirus comprising a flavivirus genome comprising one or more deletions or mutations in nucleotide sequences encoding one or more proteins selected from the group consisting of capsid (C), pre-membrane

(prM), envelope (E), non-structural protein 1 (NS1), non-structural protein 3 (NS3), and non-structural protein 5 (NS5), wherein the flavivirus genome comprises West Nile virus sequences in which sequences encoding pre-membrane and envelope proteins are replaced with sequences encoding pre-membrane and envelope proteins of a tick-borne encephalitis or a Langat virus, and the sequences encoding the signal sequence between the capsid and pre-membrane proteins of the flavivirus genome comprise sequences encoding a tick-borne encephalitis or a Langat virus capsid/pre-membrane signal sequence, or a variant thereof.

50. A replication-deficient pseudoinfectious flavivirus comprising a flavivirus genome comprising one or more deletions or mutations in nucleotide sequences encoding one or more proteins selected from the group consisting of capsid (C), pre-membrane (prM), envelope (E), non-structural protein 1 (NS1), non-structural protein 3 (NS3), and non-structural protein 5 (NS5), wherein any capsid (C) and non-structural (NS) proteins in said flavivirus genome are from Langat virus and any pre-membrane (prM) and envelope (E) proteins are from a tick-borne encephalitis virus.