

[0011a] In one aspect, there is provided a recombinant vaccinia virus comprising the polynucleotide as described herein.

[0012] In certain embodiments, the disclosure is directed to a recombinant vaccinia virus comprising a polynucleotide encoding a fusion protein comprising (a) a first polypeptide segment comprising the human heavy chain CHI domain and (b) a second polypeptide segment comprising the transmembrane domain of a vaccinia extracellular enveloped virus (EEV)-specific membrane protein. In another aspect, there is provided a host cell infected with the recombinant vaccinia virus as described herein.

[0012a] In one aspect, there is provided recombinant vaccinia library comprising a library of polynucleotides encoding a plurality of immunoglobulin fusion polypeptides comprising different immunoglobulin heavy chain variable regions,, each immunoglobulin fusion polypeptide comprising, in N- to C-terminal order, a heavy chain variable domain fused to a CHI constant domain fused to a polypeptide segment comprising the transmembrane domain of an EEV-specific membrane protein, wherein the library of polynucleotides is constructed in a vaccinia virus vector, and wherein each polynucleotide in the library comprises the following elements:

(a) a first polynucleotide encoding a first polypeptide segment comprising a heavy chain IgG CHI domain;

(b) a second polynucleotide encoding a second polypeptide segment comprising the stalk region, the transmembrane domain, and the intracellular domain of vaccinia virus A56R EEV-specific membrane protein, situated downstream of the first polynucleotide encoding the first polypeptide segment; and

(c) a third polynucleotide encoding an immunoglobulin heavy chain variable region (VH) or fragment thereof situated upstream of the first polynucleotide encoding the first polypeptide segment; wherein the immunoglobulin fusion protein can be expressed on the surface of a vaccinia EEV particle, and wherein the fusion protein can combine with an immunoglobulin light chain to form an antigen-binding domain of an immunoglobulin molecule.

[0013] In another embodiment, the disclosure is directed to recombinant vaccinia library comprising a first library of polynucleotides constructed in a vaccinia virus vector encoding a plurality of immunoglobulin fusion polypeptides, wherein the vaccinia virus vector comprises (a) a first polynucleotide encoding a first polypeptide segment comprising a heavy chain CHI domain (b) a second polynucleotide encoding a second polypeptide segment comprising the transmembrane domain of a vaccinia virus EEV-specific membrane protein situated downstream of the CHI domain, and (c) a third polynucleotide encoding an immunoglobulin heavy chain variable region or fragment thereof situated upstream of the CHI domain. In one embodiment, the first library further comprising a signal peptide for facilitating expression of the fusion polypeptides on the surface of EEV. In another embodiment, the EEV-specific membrane protein is A56R. In another embodiment, the vaccinia EEV-specific membrane protein is A56R. In another embodiment, the second polypeptide segment further comprises the extracellular domain of the EEV-specific membrane protein, or a portion thereof. In another embodiment, the second polypeptide segment further comprises the intracellular domain of the EEV-specific membrane protein, or a portion thereof. In certain embodiments, the fusion protein comprises amino acids of SEQ ID NO: 11 which correspond to the polypeptide sequence amino acids 108 to 314 of A56R from Western

protein can be expressed on the surface of a vaccinia extracellular enveloped virus (EEV) virus particle, and wherein the fusion protein when combined with a light chain variable domain can form a functional antibody or antigen binding fragment thereof.

14. The fusion protein of claim 13, further comprising a signal peptide for facilitating expression of the fusion polypeptides on the surface of EEV.

15. A polynucleotide encoding the fusion protein of claim 13 or claim 14.

16. A vector comprising the polynucleotide of claim 15.

17. A recombinant vaccinia virus comprising the polynucleotide of claim 15 or the vector of claim 16.

18. A host cell infected with the recombinant vaccinia virus of claim 17.

19. A recombinant vaccinia library comprising a library of polynucleotides encoding a plurality of immunoglobulin fusion polypeptides comprising different immunoglobulin heavy chain variable regions, each immunoglobulin fusion polypeptide comprising, in N- to C-terminal order, a heavy chain variable domain fused to a CH1 constant domain fused to a polypeptide segment comprising the transmembrane domain of an EEV-specific membrane protein, wherein the library of polynucleotides is constructed in a vaccinia virus vector, and wherein each polynucleotide in the library comprises the following elements:

(a) a first polynucleotide encoding a first polypeptide segment comprising a heavy chain IgG CH1 domain;

(b) a second polynucleotide encoding a second polypeptide segment comprising the stalk region, the transmembrane domain, and the intracellular domain of vaccinia virus A56R EEV-specific membrane protein, situated downstream of the first polynucleotide encoding the first polypeptide segment; and

(c) a third polynucleotide encoding an immunoglobulin heavy chain variable region (VH) or fragment thereof situated upstream of the first polynucleotide encoding the first polypeptide segment;

wherein the immunoglobulin fusion protein can be expressed on the surface of a vaccinia EEV particle, and wherein the fusion protein can combine with an immunoglobulin light chain to form an antigen-binding domain of an immunoglobulin molecule.