

WHAT IS CLAIMED

1. An isolated fibronectin type III (FN3) domain that specifically binds to a human cluster of differentiation 8A (CD8A) protein comprising an amino acid sequence of any one of SEQ ID NO: 40-269, wherein the amino acid sequence can optionally have a residue substituted with a cysteine at a position that corresponds to residue 54 of a sequence set forth in any one of SEQ ID NOs: 79, 81, 83, 89, 122, or 68.
2. The isolated FN3 domain of claim 1, wherein the protein is conjugated to a second molecule.
3. The isolated FN3 domain of claim 2, wherein the second molecule is a detectable label.
4. The isolated FN3 domain of claim 3, wherein the detectable label is a radioactive isotope, magnetic beads, metallic beads, colloidal particles, a fluorescent dye, an electron-dense reagent, an enzyme, biotin, digoxigenin, or hapten.
5. The isolated FN3 domain of any one of claims 1 to 4, wherein the FN3 domain has a cysteine substitution at residue position 54 corresponding to an amino acid sequence set forth in any one of SEQ ID NOs: 79, 81, 83, 89, 122, or 68.
6. The isolated FN3 domain of any one of claims 1 to 5, further comprising a methionine at the N-terminus of the FN3 domain.
7. The isolated FN3 domain of any one of claims 1 to 6, wherein the FN3 domain is coupled to a half-life extending moiety.
8. The isolated FN3 domain of claim 7, wherein the half-life extending moiety is a CD8 binding molecule, albumin, an albumin variant, an albumin binding molecule, a polyethylene glycol (PEG), CD8, CD8 variant, or at least a portion of an Fc region of an immunoglobulin.
9. An isolated polynucleotide encoding the FN3 domain of any one of claims 1 to 8.
10. A vector comprising the polynucleotide of claim 9.

11. An isolated host cell comprising the vector of claim 10.
12. A method of producing the FN3 domain of any one of claims 1 to 8, comprising culturing an isolated host cell comprising a nucleic acid molecule encoding the FN3 domain under conditions such that the FN3 domain is expressed, and purifying the FN3 domain.
13. A diagnostic kit comprising the FN3 domain of any one of claims 1 to 8.
14. A capture agent comprising the FN3 domain of any one of claims 1 to 8.
15. The diagnostic kit of claim 13 or the capture agent of claim 14, wherein the FN3 domain has a cysteine substitution at residue position 54 corresponding to a sequence set forth in any one of SEQ ID NOs 79, 81, 83, 89, 122, or 68.
16. The diagnostic kit or capture agent of claim 15, wherein the substituted cysteine is conjugated to Zr-89 or I-124.
17. A method of detecting CD8-expressing cells in a biological sample previously obtained from a subject, comprising:
 - contacting the biological sample with the capture agent of claim 14; and
 - evaluating binding of the biological sample to the FN3 domain of the capture agent.
18. The method of claim 17, wherein the capture agent has a cysteine substitution at residue position 54 corresponding to a sequence set forth in any one of SEQ ID NOs 79, 81, 83, 89, 122, or 68 and the substituted cysteine is conjugated to Zr-89 or I-124.
19. The isolated FN3 domain of any one of claims 1 to 8 or the diagnostic kit of claim 13 or the capture reagent of claim 14 for use in a method of detecting human CD8A in a biological sample.
20. The method of claim 17 or 18 or the isolated FN3 domain, diagnostic kit or capture reagent for use according to claim 19, wherein detection of human CD8A in the biological sample is indicative that a subject from which the biological sample was obtained has cancer.