CLAIMS

1. An HLA class II molecule comprising a DQ beta chain, wherein

(i) the DQ beta chain comprises an amino acid other than leucine at a position corresponding to amino acid residue 114 of SEQ ID NO: 1;

(ii) the DQ beta chain comprises an amino acid other than valine at a position corresponding to amino acid residue 143 of SEQ ID NO: 1; or

(iii) both (i) and (ii).

2. The HLA class II molecule of claim 1, wherein

(i) the DQ beta chain further comprises an amino acid other than asparagine at a position corresponding to amino acid residue 110 of SEQ ID NO: 1;

(ii) the DQ beta chain further comprises an amino acid other than isoleucine at a position corresponding to amino acid residue 116 of SEQ ID NO: 1;

(iii) the DQ beta chain further comprises an amino acid other than serine at a position corresponding to amino acid residue 118 of SEQ ID NO: 1;

(iv) the DQ beta chain further comprises an amino acid other than proline at a position corresponding to amino acid residue 146 of SEQ ID NO: 1; or

(v) any combination of (i) to (iv).

3. The HLA class II molecule of claim 1 or 2, wherein

(i) the amino acid other than leucine at a position corresponding to amino acid residue 114 of SEQ ID NO: 1 comprises a hydrophobic side chain, optionally wherein the amino acid other than leucine at a position corresponding to amino acid residue 114 of SEQ ID NO: 1 is selected from the group consisting of an alanine, a valine, an isoleucine, a methionine, a phenylalanine, a tyrosine, and a tryptophan;

(ii) the amino acid other than valine at a position corresponding to amino acid residue 143 of SEQ ID NO: 1 comprises a hydrophobic side chain, optionally wherein the amino acid other than valine at a position corresponding to amino acid residue 143 of SEQ ID NO: 1 is selected from an alanine, an isoleucine, a leucine, a methionine, a phenylalanine, a tyrosine, and a tryptophan; or

(iii) both (i) and (ii).

4. The HLA class II molecule of any one of claims 1 to 3, wherein:

(i) the amino acid other than leucine at a position corresponding to amino acid residue 114 of SEQ ID NO: 1 is a tryptophan;

(ii) the amino acid other than valine at a position corresponding to amino acid residue 143 of SEQ ID NO: 1 is a methionine; or

(iii) both (i) and (ii).

5. The HLA class II molecule of any one of claims 2 to 4, wherein

(i) the beta chain of the HLA class II molecule comprises an amino acid other than asparagine at a position corresponding to amino acid residue 110 of SEQ ID NO: 1;

(ii) the beta chain of the HLA class II molecule comprises an amino acid other than isoleucine at a position corresponding to amino acid residue 116 of SEQ ID NO: 1;

(iii) the beta chain of the HLA class II molecule comprises an amino acid other than serine at a position corresponding to amino acid residue 118 of SEQ ID NO: 1;

(iv) the beta chain of the HLA class II molecule comprises an amino acid other than proline at a position corresponding to amino acid residue 146 of SEQ ID NO: 1; or

(v) any combination of (i) to (iv).

6. The HLA class II molecule of any one of claims 2 to 5, wherein:

(i) the amino acid other than asparagine at a position corresponding to amino acid residue 110 of SEQ ID NO: 1 is selected from a serine, a threonine, and a glutamine:

(ii) the amino acid other than isoleucine at a position corresponding to amino acid residue 116 of SEQ ID NO: 1 is selected from an alanine, a valine, a leucine, a methionine, a phenylalanine, a tyrosine, and a tryptophan;

(iii) the amino acid other than serine at a position corresponding to the amino acid residue 118 of SEQ NO: 1 is selected from an arginine, a histidine, and a lysine;

(iv) the amino acid other than proline at a position corresponding to the amino acid residue 146 of SEQ NO: 1 is selected from a serine, a threonine, an asparagine, and a glutamine; or

(v) any combination of (i) to (iv).

7. The HLA class II molecule of any one of claims 2 to 6, wherein:

(i) the amino acid other than asparagine at a position corresponding to amino acid residue 110 of SEQ ID NO: 1 is a glutamine;

(ii) the amino acid other than isoleucine at a position corresponding to amino acid residue 116 of SEQ ID NO: 1 is valine;

(iii) the amino acid other than serine at a position corresponding to amino acid residue 118 of SEQ ID NO: 1 is a histidine;

(iv) the amino acid other than proline at a position corresponding to amino acid residue 146 of SEQ ID NO: 1 is a glutamine; or

(v) any combination of (i) to (iv).

8. The HLA class II molecule of any one of claims 1 to 7, wherein the DQ beta chain comprises an amino acid sequence having at least about 80% sequence identity to an amino acid sequence selected from SEQ ID NOs: 1, 3, 4, and 5.

9. The HLA class II molecule of any one of claims 1 to 8, wherein the DQ beta chain comprises the amino acid sequence set forth in SEQ ID NO: 3 or 4.

10. The HLA class II molecule of any one of claims 1 to 9, wherein the beta chain of the HLA class II molecule comprises a DQ2, DQ3, DQ4, DQ5, or DQ6 allele.

11. The HLA class II molecule of any one of claims 1 to 10, further comprising a DQ alpha chain.

12. The HLA class II molecule of claim 11, wherein the DQ alpha chain comprises an amino acid sequence having at least about 80% sequence identity to SEQ ID NO: 6 or 8.

13. The HLA class II molecule of claim 12, wherein the DQ alpha chain comprises the amino acid sequence set forth in SEQ ID NO: 6 or 8.

14. The HLA class II molecule of any one of claims 1 to 13, wherein:

(a) the DQ beta chain has an increased affinity for a CD4 protein as compared to a reference HLA class II molecule, wherein the reference HLA class II molecule comprises a DQ beta chain comprising (i) a leucine at a position corresponding to amino acid residue 114 of SEQ ID NO: 1 and/or (ii) a valine at a position corresponding to amino acid residue 143 of SEQ ID NO: 1;

(b) the DQ beta chain is bound to a membrane of a cell;

(c) the DQ beta chain comprises an extracellular domain of a full length DQ alpha chain;

(d) the DQ beta chain is linked to or associated with an inert particle;

(e) the DQ beta chain comprises a signal peptide;

(f) the HLA class II molecule further comprises a DQ alpha chain bound to a membrane of a cell;

(g) the HLA class II molecule further comprises a DQ alpha chain comprising an extracellular domain of a full length DQ alpha chain; or

(h) any combination of (a)-(g).

15. A nucleic acid molecule encoding the HLA class II molecule of any one of claims 1 to 14.

16. A vector comprising the nucleic acid molecule of claim 15.

17. A cell comprising the HLA class II molecule of any one of claims 1 to 14, the nucleic acid molecule of claim 15, or the vector of claim 16.

18. A method of identifying a T cell receptor capable of binding an epitope in an HLA class II complex, comprising pulsing the cell of claim 17 with one or more peptide comprising the epitope, and stimulating one or more $CD4^+$ T cell with the APC.

19. Use of the HLA class II molecule of any one of claims 1 to 14 in the manufacture of a medicament for treating a disease or condition in a subject in need thereof.

20. A complex comprising the HLA class II molecule of any one of claims 1 to 14 and a peptide, wherein the peptide comprises $DDX3Y_{171\text{-}190}$, $HA_{255\text{-}270}$, $GPC3_{138\text{-}157}$, or any combination thereof.