Claims

1. A composition comprising a pool of different subsets of multimeric major histocompatibility complexes (multimeric MHC),

   wherein each subset of multimeric MHC comprises i) two or more MHC molecules linked to a backbone molecule, and ii) at least one nucleic acid molecule linked to said backbone, said at least one nucleic acid molecule comprising a 5' first primer region, a central region (barcode region), and a 3' second primer region, wherein said barcode serves as a specific label for a given peptide-MHC molecule,

   wherein each subset of multimeric MHC has a different peptide decisive for T cell recognition and an associated unique nucleic acid molecule comprising a barcode region, wherein each barcode in each subset of multimeric MHC have shared amplification ends, enabling amplification of all barcodes simultaneously in a PCR reaction.

2. The composition according to claim 1, wherein the backbone molecule is selected from the group consisting of polysaccharides, including glucans such as dextran, a streptavidin or a streptamer multimer.

3. The composition according to any of the preceding claims, wherein
   a. the two or more MHC molecules are coupled to the backbone through a streptavidin-biotin binding and/or streptavidin-avidin and/or via the MHC heavy chain and/or via light chain (B2M), and/or
   b. the at least one nucleic acid molecule is coupled to the backbone via a streptavidin-biotin binding and/or a streptavidin-avidin binding.

4. The composition according to any of the preceding claims, wherein said multimeric MHC comprises at least four MHC molecules, such as at least eight, such as at least ten, such as 2-30, such as 2-20, such as 2-10, such as 4-10 or such as 15-30 MHC molecules.

5. The composition according to any of the preceding claims, wherein each of the at least one nucleic acid molecule(s) has a length of 20-200 nucleotides, such

as 20-150, such as 20-100, such as 30-100, such as 30-80, such as 30-50 nucleotides.

6. The composition according to any of the preceding claims, wherein the at least one nucleic acid molecule comprises or consists of DNA, RNA, and/or artificial nucleotides such as PNA or LNA.

7. The composition according to any of the preceding claims, wherein the MHC is selected from the group consisting of a class I MHC, a class II MHC and a CD1.

8. The composition according to any of the preceding claims, wherein the backbone further comprises one or more selectable tags or labels, such as one or more labels selected from the group consisting of fluorescent labels, His-tags, metal-ion tags.

9. A method for detecting antigen responsive cells, such as multiple antigen responsive cells, in a sample comprising:
   i) providing a composition comprising a pool of different subsets of multimeric MHC according to any of claims 1-8;
   ii) contacting said composition with said sample; and
   iii) detecting binding of each of the multimeric MHC to said antigen responsive cells, thereby detecting cells responsive to an antigen present in each subset of multimeric MHCs,
   wherein said binding is detected by amplifying the barcode regions of said nucleic acid molecules linked to the one or more multimeric MHCs by PCR.

10. The method according to claim 9, wherein the sample is selected from the group consisting of a blood sample, such as a peripheral blood sample; a blood derived sample; a tissue sample, and a body fluid, such as spinal fluid or saliva.

11. The method according to any of claims 9-10, wherein the method further comprises one or more steps of cell selection by a method selected from the group consisting of flow cytometry such as FACS; magnetic-bead based selection; size-exclusion; gradient centrifugation; column attachment and gel-filtration.

12. The method according to any of claims 9-11, wherein the amplified barcode regions of each of said nucleic acid molecules linked to each subset of multimeric MHCs are detected by sequencing of said barcode regions, such as by deep sequencing, high-throughput sequencing, next generation sequencing, or by detection of said barcode region by PCR such as QPCR.

13. A method of diagnosis of a disease or condition, preferably cancer and/or infectious diseases, said method comprising:

i) providing a sample obtained from a mammal,

ii) providing a multimeric major histocompatibility complex comprising i) two or more MHC molecules linked to a backbone molecule, and ii) at least one nucleic acid molecule linked to said backbone, said at least one nucleic acid molecule comprising a 5' first primer region, a central region (barcode region), and a 3' second primer region, wherein said barcode serves as a specific label for a given peptide-MHC molecule; or a composition according to claims 1-8,

iii) contacting said multimeric MHC or said composition with said sample; and

iv) detecting binding of the multimeric MHC to antigen responsive cells in said sample, wherein said binding is detected by amplifying the barcode regions of said nucleic acid molecules linked to the one or more multimeric MHCs by PCR, thereby diagnosing said disease or condition.