

CLAIMS

WHAT IS CLAIMED IS:

1. A method for detecting an immune response to a pathogen by a subject, comprising:
 - i) incubating a blood sample from said subject in a container comprising an antigen and an anticoagulation agent, wherein said antigen comprises a specific T cell recognized epitope of said pathogen, and
 - ii) incubating a second blood sample from said subject in a second container comprising said anticoagulation agent in (i) and not said antigen,
 - iii) quantifying an amount of an immune-response analyte in said container and said second container, wherein said immune-response analyte is a nucleic acid, wherein said quantifying comprises amplifying the nucleic acid and performing nanopore sequencing,
 - iv) comparing said amount of said immune-response analyte in said container and said second container to determine whether the subject has an immune response to said pathogen.
2. The method of claim 1, further comprising isolating total RNA from said container.
3. The method of claim 1 or 2, wherein said amplifying in (iii) comprises loop-mediated isothermal proliferation (LAMP).
4. The method of any one of claims 1 to 3, wherein said nucleic acid encodes IFN-gamma or IL-2.
5. The method of any one of claims 1 to 4, wherein said incubating in step (i) and step (ii) is done for less than or equal to 4 hours.
6. The method of any one of claims 1 to 5, wherein said determining is done within 96 hours of said incubating.
7. The method of any one of claims 1 to 6, wherein said determining is done with a specificity of at least 95%.
8. The method of any one of claims 1 to 7, wherein said determining is done with a sensitivity of at least 80%.
9. The method of any one of claims 1 to 8, wherein said subject has a latent infection of said pathogen.
10. The method of any one of claims 1 to 9, wherein said pathogen is SARS-CoV-2.
11. The method of any one of claims 1 to 10, wherein said antigen comprises a peptide comprising at least 15 consecutive amino acids of SEQ ID NO: 1 or SEQ ID NO: 2.
12. The method of any one of claims 1 to 11, wherein said container further comprises a second antigen comprising a specific T cell recognized epitope of a second pathogen, wherein said second container does not comprise said second antigen, and wherein said comparing in (iv) comprises comparing

- said amount of said immune-response analyte in said container and said second container to determine whether the subject has an immune response to said second pathogen.
13. The method of any one of claims 1 to 12, further comprising v) quantifying an amount of a second immune-response analyte in said container and said second container, and vi) comparing said amount of said second immune-response analyte in said container and said second container to determine whether said subject has an immune response to said pathogen.
 14. The method of claim 13, wherein said comparing in vi) comprises comparing a ratio of said immune-response analyte to said second immune-response analyte in said container and said second container to determine whether said subject has an immune response to said pathogen.
 15. The method of any one of claims 1 to 11, further comprising v) detecting said pathogen in said sample, wherein said detecting comprises amplifying a nucleic acid of said pathogen .
 16. A method for detecting an immune response to a SARS-Cov2 virus by a subject, comprising:
 - i) incubating a whole blood sample from said subject in a container comprising lithium heparin, glucose, an aluminum adjuvant, and a specific SARS-Cov2 antigen for at least 24 hours,
 - ii) incubating a second whole blood sample from said subject in a second container comprising lithium heparin, glucose, an aluminum adjuvant, and not a SARS-Cov2 antigen, and
 - iii) quantifying an amount of an IFN-gamma mRNA in said container and said second container to determine whether said subject has an immune response to said SARS-Cov2 virus, wherein said aluminum adjuvant and said SARS-Cov2 antigen are at a ratio of 1:1 to 3:1 by weight, wherein weight of said aluminum adjuvant is as measured by weight of aluminum ion, wherein said SARS-Cov2 antigen comprises the peptide sequence of SEQ ID NO: 2.
 17. The method of claim 16, wherein said quantifying in (iii) comprises amplifying said IFN-gamma mRNA using primers selected from Table 2.
 18. The method of claim 17, wherein said amplifying comprises loop-mediated isothermal proliferation (LAMP).
 19. The method of any one of claims 16 to 18, wherein said quantifying in (iii) further comprises nanopore sequencing.
 20. The method of any one of claims 16 to 19, wherein said determining in (iii) is done within 96 hours of said incubating and with a specificity of at least 95% and a sensitivity of at least 80%.