CLAIMS

1. A recombinant adenovirus derived from a recombinant adenovirus plasmid vector, wherein the recombinant adenovirus plasmid vector comprises a nucleotide sequence encoding:

a *Plasmodium* circumsporozoite protein gene, or antigenic portion thereof, operably linked to a heterologous promoter sequence, and

one or more modified capsid and/or core protein genes, wherein an immunogenic epitope sequence of *Plasmodium* circumsporozoite has been inserted into or replaces at least part of the one or more capsid or core protein genes; and

wherein the immunogenic epitope sequence is a B cell epitope sequence selected from $(NANP)_{12}$, $(NANP)_{14}$, $(NANP)_{16}$, $(NANP)_{18}$, $(NANP)_{20}$, or $(NANP)_{22}$.

2. The adenovirus according to claim 1, wherein the *Plasmodium* circumsporozoite protein gene further comprises a *Plasmodium falciparum* circumsporozoite protein gene.

3. The adenovirus according to claim 1, wherein the *Plasmodium* circumsporozoite protein gene further comprises a codon-optimized *Plasmodium falciparum* circumsporozoite protein gene.

4. The adenovirus according to claim 3, wherein the codon-optimized protein gene is encoded by SEQ ID NO:2.

5. The adenovirus according to any of claims 1-4, wherein the one or more modified capsid and/or core protein genes comprises a Hexon hypervariable region (HRV) sequence.

6. The adenovirus according to claim 5, wherein the HRV sequence comprises an HRV1 or HRV5 sequence and the B cell epitope sequence:

a) is inserted in the HVR1 or HVR5 sequence; or

b) replaces a portion of the HVR1 or HRV5 sequence.

7. The adenovirus according to claim 6, wherein the modified capsid protein gene is encoded by a nucleic acid sequence selected from the group consisting of, SEQ ID

NO:16, SEQ ID NO:17, SEQ ID NO:18, SEQ ID NO:19, SEQ ID NO:20, SEQ ID NO:21, or SEQ ID NO:22.

8. The adenovirus according to claim 1, wherein the one or more modified capsid and/or core protein genes comprises a capsid Fiber protein gene and the B cell epitope sequence is inserted into the Fiber protein gene.

9. The adenovirus according to claim 8, wherein the modified capsid protein gene is encoded by SEQ ID NO:25.

10. The adenovirus according to claim 1, wherein the core protein gene further comprises a pVII protein gene and the CD4+ T cell epitope sequence is inserted into the pVII protein gene.

11. The adenovirus according to claim 10, wherein the modified core protein gene is encoded by SEQ ID NO:27, SEQ ID NO:28 or SEQ ID NO:29.

12. The adenovirus according to claim 10 or 11, wherein the CD4+ T cell epitope sequence is a *Plasmodium falciparum* circumsporozoite protein gene CD4+ T cell epitope sequence.

13. The adenovirus according to any one of claims 10 to 12, wherein the CD4+ T cell epitope sequence is EYLNKIQNSLSTEWSPCSVT (SEQ ID NO:62).

14. The adenovirus according to claim 1, wherein the adenovirus is produced from any one of the recombinant adenovirus plasmid vectors selected from the group consisting of an HVR1-modified adenovirus vector, a Fiber-modified adenovirus vector, an HVR1 and Fiber-modified adenovirus vector, a Fiber and pVII-modified adenovirus vector, an HVR1 and pVII-modified adenovirus vector and an HVR1, Fiber and pVII-modified adenovirus vector.

15. A recombinant adenovirus derived from a recombinant adenovirus plasmid vector, wherein the recombinant adenovirus plasmid vector comprises a nucleotide sequence encoding:

a *Plasmodium* circumsporozoite protein gene, or antigenic portion thereof, operably linked to a heterologous promoter sequence, and

one or more modified capsid and/or core protein genes, wherein an immunogenic epitope sequence of *Plasmodium* circumsporozoite has been inserted into or replaces at least part of the one or more capsid and/or core protein genes; and

wherein the core protein gene comprises a pVII protein gene and a CD4+ T cell epitope sequence is inserted into the pVII protein gene.

16. The adenovirus according to claim 15 wherein the modified core protein gene is encoded by SEQ ID NO:27, SEQ ID NO:28 or SEQ ID NO:29.

17. The adenovirus according to claim 15 or claim 16, wherein the CD4+ T cell epitope sequence is a *Plasmodium falciparum* circumsporozoite protein gene CD4+ T cell epitope sequence.

18. The adenovirus according to claim 17, wherein the CD4+ T cell epitope sequence is EYLNKIQNSLSTEWSPCSVT (SEQ ID NO:62).

19. Use of a recombinant adenovirus according to any one of claims 1-18 in the manufacture of a medicament which induces a cellular and humoral response against a *Plasmodium* circumsporozoite protein for the treatment or prevention of malaria.

20. The use according to claim 19, wherein the medicament further comprises an adjuvant.

21. The use according to claim 19, wherein the medicament is prepared for administration of at least two doses of the medicament.

22. A pharmaceutical composition comprising a recombinant adenovirus according to any one of claims 1-18, wherein the recombinant adenovirus is produced from any one of the recombinant adenovirus plasmid vectors selected from the group consisting of an HVR1-modified adenovirus vector, a Fiber-modified adenovirus vector, an HVR1 and Fiber-modified adenovirus vector, a Fiber and pVII-modified adenovirus vector, an HVR1 and pVII-modified adenovirus vector and an HVR1, Fiber and pVII-modified adenovirus vector.

23. A vaccine for malaria infection comprising a recombinant adenovirus according to any one of claims 1-18, wherein the recombinant adenovirus is produced from any one of the recombinant adenovirus plasmid vectors selected from the group consisting of an HVR1-modified adenovirus vector, a Fiber-modified adenovirus vector,

an HVR1 and Fiber-modified adenovirus vector, a Fiber and pVII-modified adenovirus vector, an HVR1 and pVII-modified adenovirus vector and an HVR1, Fiber and pVII-modified adenovirus vector.

24. The vaccine for malaria infection according to claim 23, wherein the vaccine is administered to the subject intramuscularly, intradermally or subcutaneously.

25. The vaccine for malaria infection according to claim 23, wherein the vaccine is administered with an adjuvant to the subject.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A recombinant adenovirus derived from a recombinant adenovirus plasmid vector, wherein the recombinant adenovirus plasmid vector comprises a nucleotide sequence encoding:

a *Plasmodium* circumsporozoite protein gene, or antigenic portion thereof, operably linked to a heterologous promoter sequence, and

one or more modified capsid and/or core protein genes, wherein an immunogenic epitope sequence of *Plasmodium* circumsporozoite has been inserted into or replaces at least part of the one or more capsid and/or core protein genes,

wherein the immunogenic epitope sequence is a B cell epitope sequence selected from $(NANP)_{12}$, $(NANP)_{14}$, $(NANP)_{16}$, $(NANP)_{18}$, $(NANP)_{20}$, or $(NANP)_{22}$.

2. The adenovirus of claim 1, wherein the *Plasmodium* circumsporozoite protein gene further comprises a *Plasmodium falciparum* or a *Plasmodium yoelii* circumsporozoite protein gene.

3. The adenovirus of claim 1, wherein the *Plasmodium* circumsporozoite protein gene further comprises a codon-optimized *Plasmodium falciparum* or *Plasmodium yoelii* circumsporozoite protein gene.

4. The adenovirus of claim 3, wherein the codon-optimized protein gene is encoded by SEQ ID NO:2.

5. The adenovirus of any one of claims 1-4, wherein the one or more modified capsid and/or core protein genes comprise a Hexon hypervariable region (HRV) sequence.

6. The adenovirus of claim 5, wherein the HRV sequence comprises an HRV1 or HRV5 sequence and the B cell epitope sequence:

a) is inserted in the HVR1 or HVR5 sequence; or

b) replaces a portion of the HVR1 or HRV5 sequence.

7. The adenovirus of claim 6, wherein the modified capsid protein gene is encoded by a nucleic acid sequence selected from the group consisting ofSEQ ID NO:16, SEQ ID NO:17, SEQ ID NO:18, SEQ ID NO:19, SEQ ID NO:20, SEQ ID NO:21, or SEQ ID NO:22.

8. The adenovirus of claim 1, wherein the one or more modified capsid and/or core protein genes comprise a capsid Fiber protein gene and the B cell epitope sequence is inserted into the Fiber protein gene.

9. The adenovirus of claim 8, wherein the modified capsid protein gene is encoded by SEQ ID NO:25.

10. The adenovirus of claim 1, wherein the core protein gene further comprises a pVII protein gene and the CD4+ T cell epitope sequence is inserted into the pVII protein gene.

11. The adenovirus of claim 10, wherein the modified core protein gene is encoded by SEQ ID NO:27, SEQ ID NO:28 or SEQ ID NO:29.

12. The adenovirus of claim 10 or 11, wherein the CD4+ T cell epitope sequence is a *Plasmodium falciparum* circumsporozoite protein gene CD4+ T cell epitope sequence.

13. The adenovirus of any one of claims 10-12, wherein the CD4+ T cell epitope sequence is EYLNKIQNSLSTEWSPCSVT (SEQ ID NO:62).

14. The adenovirus of claim 1, wherein the adenovirus is produced from any one of the recombinant adenovirus plasmid vectors selected from the group consisting of an HVR1-modified adenovirus vector, a Fiber-modified adenovirus vector, an HVR1 and Fiber-modified adenovirus vector, a Fiber and pVII-modified adenovirus vector, an HVR1 and pVII-modified adenovirus vector and an HVR1, Fiber and pVII-modified adenovirus vector.

15. A recombinant adenovirus derived from a recombinant adenovirus plasmid vector, wherein the recombinant adenovirus plasmid vector comprises a nucleotide sequence encoding:

a *Plasmodium* circumsporozoite protein gene, or antigenic portion thereof, operably linked to a heterologous promoter sequence, and

one or more modified capsid and/or core protein genes, wherein an immunogenic epitope sequence of *Plasmodium* circumsporozoite has been inserted into or replaces at least part of the one or more capsid and/or core protein genes;

wherein the core protein gene comprises a pVII protein gene and a CD4+ T cell epitope sequence is inserted into the pVII protein gene.

16. The adenovirus of claim 15 wherein the modified core protein gene is encoded by SEQ ID NO:27, SEQ ID NO:28 or SEQ ID NO:29.

17. The adenovirus of claim 15 or 16, wherein the CD4+ T cell epitope sequence is a *Plasmodium falciparum* circumsporozoite protein gene CD4+ T cell epitope sequence.

18. The adenovirus of claim 17, wherein the CD4+ T cell epitope sequence is EYLNKIQNSLSTEWSPCSVT (SEQ ID NO:62).

19. Use of a recombinant adenovirus of any one of claims 1-18 in the manufacture of a medicament for the treatment or prevention of malaria, wherein the treatment of prevention of malaria induces a cellular and humoral immune response against a *Plasmodium* circumsporozoite protein.

20. The use according to claim 19, wherein the medicament further comprises an adjuvant.

21. The use according to claim 19, wherein the treatment or prevention of malaria requires at least two doses of treatment.

22. A pharmaceutical composition comprising a recombinant adenovirus of any one of claims 1-18.

23. The pharmaceutical composition of claim 22, further comprising an adjuvant.

24. A pharmaceutical composition when used for inducing a cellular and humoral immune response against a *Plasmodium* circumsporozoite protein in a subject comprising the recombinant adenovirus of any one of claims 1-18.

25. The pharmaceutical composition of claim 24, further comprising an adjuvant.

26. A vaccine for malaria infection comprising the recombinant adenovirus of any one of claims 1-18.

27. A method for inducing a cellular and humoral immune response against a *Plasmodium* circumsporozoite protein and/or for the treatment or prevention of malaria in a subject, comprising administering to the subject the recombinant adenovirus of any one of claims 1-18, the pharmaceutical composition of any one of claims 22-25 or the vaccine of claim 26.

28. The method of claim 27, wherein the recombinant adenovirus, pharmaceutical composition or vaccine is administered to the subject intramuscularly, intradermally or subcutaneously.

29. The method of claim 27 or 28, wherein the recombinant adenovirus, pharmaceutical composition or vaccine is administered to the subject with an adjuvant.