

CLAIMS

1. A method of treating or preventing an infection, a neoplastic disease or an immune-related disease in a subject in need thereof, the method comprising contacting a therapeutically effective or immuno-effective amount of an TLR9 agonist with a precursor dendritic cell (pre-DC), wherein the TLR9 agonist stimulates the pre-DC to secrete one or more cytokines, to thereby activate or increase the subject's immune response for treating or preventing the infection, the neoplastic disease or the immune-related disease.
2. The method of claim 1, wherein the contacting is carried out *in vitro*, *in vivo* or *ex vivo*.
3. The method of claim 1 or 2, wherein the pre-DC is one that presents an antigen (or a fragment thereof) associated with the infection, the neoplastic disease or the immune related disease.
4. The method of any one of claims 1 to 3, wherein the infection is selected from the group consisting of a bacterial infection and a viral infection.
5. The method of any one of claims 1 to 3, wherein the immune-related disease is an inflammatory disease or an autoimmune disease.
6. The method of claim 5, wherein the autoimmune disease is selected from the group consisting of systemic lupus erythematosus (SLE) and Sjögren's syndrome.
7. The method of any one of claims 1 to 6, wherein the one or more TLR9 agonists is an oligodeoxynucleotide.
8. The method of claim 7, wherein the oligodeoxynucleotide is selected from the group consisting of CpG oligodeoxynucleotide (ODN) Class A, CpG ODN Class B and CpG ODN Class C.
9. The method of claim 7 or 8, wherein the CpG ODN Class A is CpG ODN 2216.
10. The method of any one of claims 1 to 9, wherein the method further comprises using an antigen delivery system that specifically targets pre-DC and committed pre-DC.
11. The method of claim 10, wherein the antigen delivery system comprises an antibody that specifically targets pre-DC and committed pre-DC.

12. The method of any one of claims 1 to 11, wherein the one or more cytokine is selected from the group consisting of interferons, tumor necrosis factors, interleukins, and chemokines.
- 5 13. The method of claim 12, wherein the interferon is IFN- α ; the tumor necrosis factor is TNF- α ; and the interleukin is IL-12p40.
- 10 14. The method of any one of claims 1 to 13, wherein the pre-DC is selected from the group consisting of early pre-DC, pre-conventional dendritic cells 1 (pre-cDC1), and pre-conventional dendritic cells 2 (pre-cDC2).
- 15 15. The method of any one of claims 1 to 14, wherein the pre-DC comprises one or more markers selected from the group consisting of CD123, CD303, CD304, CD327, CD45RA, CD85j, CD5 and BTLA.
16. The method of any one of claims 1 to 15, wherein the subject is a human.
- 20 17. The method of any one of claims 1 to 16, wherein the contacting includes administering by a route selected from the group consisting of intramuscular, intradermal, subcutaneous, intravenous, oral, topical and intranasal administration.
- 25 18. Use of one or more TLR9 agonists in the manufacture of a medicament for treating or preventing an infection, a neoplastic disease or an immune-related disease in a subject in need thereof, wherein the TLR9 agonist stimulates pre-DC to secrete one or more cytokines to thereby activate or increase the subject's immune response for treating or preventing the infection, the neoplastic disease or the immune-related disease.
- 30 19. The use of claim 18, wherein the medicament further comprises an antigen (or a fragment thereof) associated with an infection, a neoplastic disease or an immune-related disease.
- 35 20. The use of claims 18 or 19, wherein the medicament further comprises an antigen delivery system that specifically targets pre-DC and committed pre-DC.
21. The use of claim 20, wherein the antigen delivery system comprises an antibody that specifically targets pre-DC and committed pre-DC.
- 40 22. The use of any one of claims 18 to 21, wherein the medicament is a vaccine.
23. An immunogenic composition comprising one or more TLR9 agonists capable of stimulating pre-DC to secrete one or more cytokines.

24. The immunogenic composition of claim 23, further comprising an antigen (or a fragment thereof) associated with an infection, a neoplastic disease or an immune-related disease.
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25. The immunogenic composition of claim 23 or 24, further comprising an antigen delivery system that specifically targets pre-DC and committed pre-DC.
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26. The immunogenic composition of claim 25, wherein the antigen delivery system comprises an antibody that specifically targets pre-DC and committed pre-DC.
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27. The immunogenic composition of any one of claims 23 to 26, further comprising an adjuvant, a preservative, a stabilizer, an encapsulating agent (e.g. lipid membranes, chitosan particles, biocompatible polymers) and/or a pharmaceutically acceptable carrier.
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28. An adjuvant composition comprising a TLR9 agonist that is capable of stimulating pre-DC to secrete one or more cytokines for activating or increasing a subject's immune response to treat or prevent an infection, a neoplastic disease or an immune-related disease.
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29. The adjuvant composition of claim 28, further comprising an antigen (or a fragment thereof) associated with an infection, a neoplastic disease or an immune-related disease.
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30. The adjuvant composition of claim 28 or 29, further comprising an antigen delivery system that specifically targets pre-DC and committed pre-DC.
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31. The adjuvant composition of claim 30, wherein the antigen delivery system comprises an antibody that specifically targets pre-DC and committed pre-DC.
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32. A method of diagnosing a deficient immune system in a subject, said method comprising:
- (a) obtaining a sample comprising pre-DC from the subject;
- (b) contacting the sample with one or more TLR9 agonists;
- (c) detecting the presence or absence of one or more cytokines in the sample; and
- (d) diagnosing the subject as one having a deficient immune system when the one or more cytokines in the sample is absent (or not detected) or is present in a lower level when compared to a control sample.
33. The method of claim 32, wherein the contacting is conducted *in vitro* or *in vivo*.

34. The method of claim 32 or 33, further comprising contacting the sample with an antigen (or a fragment thereof) associated with an infection, a neoplastic disease or an immune-related disease, before or at the same time as step (b).
- 5 35. The method of any one of claims 32-34, further comprising using an antigen delivery system that specifically targets pre-DC and committed pre-DC.
36. The method of claim 35, wherein the antigen delivery system comprises an antibody that specifically targets pre-DC and committed pre-DC.
- 10 37. The method of any one of claims 32 to 36, further comprising treating the subject diagnosed with a deficient immune system by administering the composition of any one of claims 23 to 27, to thereby increase the subject's immune response.
- 15 38. A method of eliciting an immune response against an infection, a neoplastic disease or an immune-related disease in a subject in need thereof, the method comprising contacting an immuno-effective amount of an TLR9 agonist with pre-DC, wherein the TLR9 agonist stimulates the pre-DC to secrete one or more cytokines, to thereby elicit an immune response against the infection, the neoplastic disease or immune-related disease.
- 20 39. The method of claim 38, wherein the contacting is carried out *in vitro*, *in vivo* or *ex vivo*.
- 25 40. The method of claim 38 or 39, wherein the pre-DC is one that presents an antigen (or a fragment thereof) associated with the infection, the neoplastic disease or immune related disease.
- 30 41. The method of any one of claims 38 to 40, wherein the method further comprises using an antigen delivery system that specifically targets pre-DC and committed pre-DC.
42. The method of claim 41, wherein the antigen delivery system comprises an antibody that specifically targets pre-DC and committed pre-DC.
- 35 43. A kit for diagnosing a deficient immune system in a subject according to the method of any one of claims 32 to 37.
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