Claims

1. A method of characterising and/or separating neutrophils, the method comprising:

characterising and/or separating the neutrophils into a first population comprising proliferative neutrophils and a second population comprising mature neutrophils, according to the expression of CD101 on the neutrophils.

2. The method according to claim 1, wherein the first population expresses $CD101^-$ and the second population expresses $CD101^+$.

3. The method according to claim 1 or 2, wherein when the neutrophils are human neutrophils, the method further comprises characterising and/or separating the neutrophils according to the expression of CD10 on the neutrophils, wherein the first population comprising proliferative neutrophils are $CD10^-CD101^-$ and the second population comprising mature neutrophils are $CD10^+CD101^+$, optionally the second neutrophils population further comprises immature neutrophils that are $CD10^-CD101^+$.

4. The method according to claim 3, wherein the method further comprises characterising and/or separating the neutrophils according to the expression of one or more biomarkers selected from the group consisting of CD49d, CD16, CXCR2, CD34, CD66, CD15, CD71, and CD11b.

5. The method according to claim 1, wherein the proliferative neutrophils comprise pro-neutrophils and pre-neutrophils,

optionally wherein the pro-neutrophils are $CD101^-CD10^-CD16^-CD34^-CD66b^+CD15^+CD71^+CD49d^+CD11b^-CXCR2^-$, the pre-neutrophils are $CD101^-CD10^-CD16^-CD34^-CD66b^+CD15^+CD71^+CD49d^+CD11b^+CXCR2^-$, the immature neutrophils are $CD101^+CD10^-CD16^-CD34^-CD66b^+CD15^+CD71^-CD49d^{lo}CD11b^+CXCR2^-$, and the mature neutrophils are $CD101^+CD10^+CD16^+CD34^-CD66b^+CD15^+CD71^-CD49d^{lo}CD11b^+CXCR2^+$.

6. The method according to claim 1 or 2, wherein when the neutrophils are murine neutrophils, the method further comprises characterising and/or separating the neutrophils according to the expression of cKit on the neutrophils, wherein the first

population comprising proliferative neutrophils is one of cKit^{hi}CD101^{-}, cKit^{int}CD101^{-}, or cKit^{lo}CD101^{-} and the second population comprising mature neutrophils are cKit^{-}CD101^{+},

optionally the first neutrophils population further comprises immature neutrophils that are cKit^{lo}CD101^{+}.

7. The method according to claim 6, wherein the method further comprising characterising and/or separating the neutrophils according to the expression of one or more biomarkers selected from the group consisting of CD101, cKit, Ly6C, CD106, SiglecF, CD115, CD205, CD11b, Gr1, and CXCR4.

8. The method according to claim 6 or 7, wherein the proliferative neutrophils comprise pro-neutrophils and pre-neutrophils, optionally wherein pro-neutrophils are CD101^{-}cKit^{Hi}Ly6C^{+}CD106^{+}SiglecF^{-}CD115^{-}CD205^{-}CD11b^{Lo}Gr1^{Lo}CXCR4^{Hi}, the pre-neutrophils are CD101^{-}cKit^{lo}Ly6C^{+}CD106^{++}SiglecF^{-}CD115^{-}CD205^{+}CD11b^{Hi}Gr1^{Hi} CXCR4^{Hi} or CD101^{-}cKit^{int}Ly6C^{+}CD106^{++}SiglecF^{-}CD115^{-}CD205^{+}CD11b^{Hi}Gr1^{Hi} CXCR4^{Hi} the immature neutrophils are CD101^{-} cKit^{int}Ly6C^{+}CD106^{+}SiglecF^{-}CD115^{-} CD205^{+}CD11b^{Hi}Gr1^{Hi}CXCR4^{Lo} or CD101^{-}cKit^{lo}Ly6C^{+}CD106^{+}SiglecF^{-}CD115^{-} CD205^{+}CD11b^{Hi}Gr1^{Hi}CXCR4^{Lo} and the mature neutrophils are CD101^{+}cKit^{-} Ly6C^{+}CD106^{lo}SiglecF^{-}CD115^{-}CD205^{+}CD11b^{Hi}Gr1^{Hi}CXCR4^{Lo}.

9. A kit for separating neutrophils, the kit comprising:

an agent for detecting the expression of CD101 on the neutrophils; and/or

a separator for separating a first population comprising proliferative neutrophils and a second population comprising mature neutrophils according to the expression of CD101 on the neutrophils.

10. The kit according to claim 9, wherein the first population expresses CD101^{-} and the second population expresses CD101^{+}, the kit is for separating human neutrophils and the kit further comprises an agent for detecting the expression of CD10 on the human neutrophils, and the separator is adapted to separate the neutrophils according to the expression of CD10 on the neutrophils, wherein the first population comprising proliferative neutrophils are CD10^{-}CD101^{-}, and the second population comprising mature neutrophils are CD10^{+}CD101^{+}, optionally the second population further comprises immature neutrophils that are CD10^{-}CD101^{+}, optionally the agent for

detecting the expression of CD10 is an antibody adapted to target CD10, and/or wherein the agent for detecting the expression of CD101 is an antibody adapted to target CD101.

11. The kit according to any one of claims 9 to 10, wherein the kit further comprises an agent for detecting the expression on the neutrophils one or more biomarkers selected from a group consisting of CD49d, CD16, CXCR2, CD34, CD66, CD15, CD71, and CD11b, and wherein the separator is adapted to separate the neutrophils according to the expression of one or more of CD49d, CD16, CXCR2, CD34, CD66, CD15, CD71, and CD11b on the neutrophils,

optionally the kit is for separating murine neutrophils, and wherein the separator is further adapted to separate the neutrophils according to the expression of CD101 and/or cKit, wherein the first population comprising proliferative neutrophils is one of $cKit^{hi}CD101^{-}$, $cKit^{int}CD101^{-}$, or $cKit^{lo}CD101^{-}$ and the second population comprising mature neutrophils are $cKit\text{-}CD101^{+}$, optionally, wherein the first population further comprises immature neutrophils that are $cKit^{lo}CD101^{+}$.

12. The kit according to claim 9, wherein the agent for detecting the expression of CD101 and/or cKit is an antibody adapted to target CD101 and/or cKit, the kit further comprises an agent for detecting the expression on the neutrophils of one or more biomarkers selected from a group consisting of CD101, cKit, Ly6C, CD106, SiglecF, CD115, CD205, CD11b, Gr1, and CXCR4, and wherein the separator is adapted to separate the neutrophils according to the expression of CD101, cKit, Ly6C, CD106, SiglecF, CD115, CD205, CD11b, Gr1, and/or CXCR4 on the neutrophils.

13. A method of isolating and/or enriching a desired neutrophil, the method comprising:

categorizing neutrophils in a sample into a first population comprising proliferative neutrophils and a second population comprising mature neutrophils according to the expression of CD101 on the neutrophils; and

isolating and/or enriching one or more neutrophil from the first population and/or the second population.

14. A composition comprising proliferative neutrophils for use in treatment or for use in enhancing the immune system of a subject and/or maintaining an immune response in the subject, wherein the proliferative neutrophils are $CD10^{-}CD101^{-}$.

15. Use of proliferative neutrophils in the manufacture of a medicament for treating immunodeficiency related diseases and/or disorders in a patient and/or enhancing the immune system of a patient, wherein the proliferative neutrophils are $CD10^{-}CD101^{-}$.

16. A method for diagnosing or prognosing a medical condition in a patient, the method comprising the steps of:

(a) testing a sample comprising neutrophils obtained from a patient, to detect the expression of CD10 and/or CD101 on the neutrophils;

(b) measuring the levels of proliferative neutrophils, immature neutrophils and/or mature neutrophils in the sample, wherein proliferative neutrophils are $CD10^{-}CD101^{-}$, immature neutrophils are $CD10^{-}CD101^{+}$, and mature neutrophils are $CD10^{+}CD101^{+}$; and

(c) comparing the levels of the proliferative neutrophils, immature neutrophils and/or mature neutrophils in the sample, to reference levels in a control to determine the absence or presence of the medical condition, or to predict the course of the medical condition,

optionally the sample is a bone marrow sample and/or a spleen sample, and wherein a level of proliferative neutrophils in the sample higher than the reference level in the control indicates that the patient has an inflammatory medical condition, optionally the inflammatory medical condition is associated with an autoimmune disease, sepsis and/or cancer.

17. The method according to claim 16, wherein a level of immature neutrophils in the sample higher than the reference level in the control indicates that the patient has the medical condition, optionally the level of immature neutrophils correlates with the progression of the medical condition.

18. The method according to claim 17, wherein the sample is a blood sample or a tumor sample, and wherein the medical condition is cancer, optionally the cancer is pancreatic cancer.

19. A kit for detecting and/or predicting inflammation in a patient, the kit comprising:

an agent for detecting the expression of CD10 on neutrophils and/or an agent for detecting the expression of CD101 on neutrophils to measure the level of proliferative neutrophils in a sample taken from the patient, wherein the proliferative neutrophils are $CD10^{-}CD101^{-}$; and

a reference level for comparing the measured level of proliferative or immature neutrophils,

wherein a level of proliferative neutrophils in the sample higher than the reference level indicates that the patient has an inflammatory medical condition.

20. A kit for diagnosis and/or prognosing cancer in a patient, the kit comprising:

an agent for detecting the expression of CD10 on neutrophils and/or an agent for detecting the expression of CD101 on neutrophils to measure the level of immature neutrophils in a sample taken from the patient, wherein the immature neutrophils are $CD10^{-}CD101^{+}$; and

a reference level for comparing the measured level of immature neutrophils,

wherein a level of immature neutrophils in the sample higher than the reference level indicates that the patient has cancer, and/or wherein the level of immature neutrophils correlates with the progression of cancer.