[5] In keeping with the role of CD47 to inhibit phagocytosis of normal cells, there is evidence that it is transiently up-regulated on hematopoietic stem cells (HSCs) and progenitors just prior to and during their migratory phase, and that the level of CD47 on these cells determines the probability that they are engulfed *in vivo*.

[6] CD47 is also constitutively up-regulated on a number of cancers, including myeloid leukemias. Overexpression of CD47 on a myeloid leukemia line increases its pathogenicity by allowing it to evade phagocytosis. It has been concluded that CD47 up-regulation is an important mechanism for providing protection to normal HSCs during inflammation-mediated mobilization, and that leukemic progenitors co-opt this ability in order to evade macrophage killing.

[7] Certain CD47 antibodies have been shown to restore phagocytosis and prevent atherosclerosis. See, e.g., Kojima et al., Nature, Vol. 36, 86-90 (Aug. 4, 2016). The present invention provides novel CD47 antibodies or immunologically active fragments thereof that have low immunogenicity in humans and cause low or no level of red blood cell depletion. As well known to a person skilled in the art, such antibodies may be interchangeably called "anti-CD47 antibodies."

SUMMARY OF THE PRESENT INVENTION

[7a] In one aspect, the present invention refers to an isolated monoclonal antibody or immunologically active fragment thereof that binds to human CD47, comprising: a variable heavy (VH) chain sequence that is at least 95% identical to an amino acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 3, SEQ ID NO: 5, SEQ ID NO: 7, SEQ ID NO: 9, SEQ ID NO: 11, SEQ ID NO: 13, SEQ ID NO: 15, SEQ ID NO: 17, SEQ ID NO: 19, SEQ ID NO: 21, SEQ ID NO: 23, SEQ ID NO: 25, SEQ ID NO: 27, SEQ ID NO: 29, SEQ ID NO: 31, SEQ ID NO: 33, SEQ ID NO: 35, SEQ ID NO: 37, SEQ ID NO: 39, SEQ ID NO: 41, SEQ ID NO: 43, SEQ ID NO: 45, SEQ ID NO: 47, SEQ ID NO: 49, SEQ ID NO: 51, SEQ ID NO: 53, SEQ ID NO: 55, SEQ ID NO: 57, SEQ ID NO: 59, SEQ ID NO: 61, SEQ ID NO: 63, SEQ ID NO: 65, SEQ ID NO: 67, SEQ ID NO: 69, SEQ ID NO: 71, SEQ ID NO: 73, SEQ ID NO: 75, and SEQ ID NO: 77; and a variable light (VL) chain sequence that is at least 95% identical to an amino acid sequence selected from the group consisting of SEQ ID NO: 2, SEQ ID NO: 4, SEQ ID NO: 6, SEQ ID NO: 8, SEQ ID NO: 10, SEQ ID NO: 12, SEQ ID NO: 14, SEQ ID NO: 16, SEQ ID NO: 18, SEQ ID NO: 20, SEQ ID NO: 22, SEQ ID NO: 24, SEQ ID NO: 26, SEQ ID NO: 28, SEQ ID NO: 30, SEQ ID NO: 32, SEQ ID NO: 34, SEQ ID NO: 36,

SEQ ID NO: 38, SEQ ID NO: 40, SEQ ID NO: 42, SEQ ID NO: 44, SEQ ID NO: 46, SEQ ID NO: 48, SEQ ID NO: 50, SEQ ID NO: 52, SEQ ID NO: 54, SEQ ID NO: 56, SEQ ID NO: 58, SEQ ID NO: 60, SEQ ID NO: 62, SEQ ID NO: 64, SEQ ID NO: 66, SEQ ID NO: 68, SEQ ID NO: 70, SEQ ID NO: 72, SEQ ID NO: 74, SEQ ID NO: 76, and SEQ ID NO: 78. In another aspect, the present invention refers to an isolated bispecific monoclonal antibody comprising a first arm and a second arm, wherein the first arm comprises a first monoclonal antibody or immunologically active fragment thereof of any of claims 1-8 which binds human CD47, and the second arm comprise a second monoclonal antibody that does not bind human CD47. In yet another aspect, the present invention refers to a pharmaceutical composition comprising an isolated monoclonal antibody or immunologically active fragment thereof or a bispecific monoclonal antibody of the present invention, and a pharmaceutically acceptable carrier. In yet another aspect, the present invention provides the use of an isolated monoclonal antibody or immunologically active fragment thereof or a bispecific monoclonal antibody of the present invention, or a pharmaceutical composition of the present invention in the manufacture of a medicament for treating cancer, a fibrotic disease, a disease related to inhibition of phagocytosis, or a disease related to platelet aggregation. In yet another aspect, the present invention refers to a fusion protein comprising a first amino acid sequence and a second amino acid sequence, wherein the first amino acid sequence is SEQ ID NO: 1, SEQ ID NO: 3, SEQ ID NO: 5, SEQ ID NO: 7, SEQ ID NO: 9, SEQ ID NO: 11, SEQ ID NO: 13, SEQ ID NO: 15, SEQ ID NO: 17, SEQ ID NO: 19, SEQ ID NO: 21, SEQ ID NO: 23, SEQ ID NO: 25, SEQ ID NO: 27, SEQ ID NO: 29, SEQ ID NO: 31, SEQ ID NO: 33, SEQ ID NO: 35, SEQ ID NO: 37, SEQ ID NO: 39, SEQ ID NO: 41, SEQ ID NO: 43, SEQ ID NO: 45, SEQ ID NO: 47, SEQ ID NO: 49, SEQ ID NO: 51, SEQ ID NO: 53, SEQ ID NO: 55, SEQ ID NO: 57, SEQ ID NO: 59, SEQ ID NO: 61, SEQ ID NO: 63, SEQ ID NO: 65, SEQ ID NO: 67, SEQ ID NO: 69, SEQ ID NO: 71, SEQ ID NO: 73, SEQ ID NO: 75, or SEQ ID NO: 77, or an amino acid sequence that is at least 95% identical thereto; and the second amino acid sequence is SEQ ID NO: 2, SEQ ID NO: 4, SEQ ID NO: 6, SEQ ID NO: 8, SEQ ID NO: 10, SEQ ID NO: 12, SEQ ID NO: 14, SEQ ID NO: 16, SEQ ID NO: 18, SEQ ID NO: 20, SEQ ID NO: 22, SEQ ID NO: 24, SEQ ID NO: 26, SEQ ID NO: 28, SEQ ID NO: 30, SEQ ID NO: 32, SEQ ID NO: 34, SEQ ID NO: 36, SEQ ID NO: 38, SEQ ID NO: 40, SEQ ID NO: 42, SEQ ID NO: 44, SEQ ID NO: 46, SEQ ID NO: 48, SEQ ID NO: 50, SEQ ID NO: 52, SEQ ID NO: 54, SEQ ID NO: 56, SEQ ID NO: 58, SEQ ID NO: 60, SEQ ID NO: 62, SEQ ID NO: 64, SEQ ID NO: 66, SEQ ID NO: 68, SEQ ID NO: 70, SEQ ID NO: 72, SEQ ID NO: 74, SEQ ID NO: 76, or SEQ ID NO: 78, or an amino acid sequence that is at least 95% identical thereto. In yet another

aspect, the present invention refers to an immunodominant epitope encoded by the CD47 gene comprising a recombinant protein containing conformationally a TNMEAQ loop (residues 26-31), T34, E35, L74, and an LTR hinge (residues 101-103) of CD47. In yet another aspect, the present invention provides a biological molecule that specifically binds to a conformational epitope having an amino acid sequence comprising a TNMEAQ loop (residues 26-31), T34, E35, L74, and an LTR hinge (residues 101-103) of CD47, wherein the antibody can specifically bind to CD47.

[8] In one example, the present disclosure provides isolated monoclonal antibodies and their immunologically active fragments that bind to human CD47. For brevity, these CD47-binding isolated monoclonal antibodies and their immunologically active fragments are referred to hereinafter as "CD47 antibodies". The CD47 antibodies of this disclosure are capable of modulating, e.g., blocking, inhibiting, reducing, antagonizing, neutralizing or otherwise interfering with, CD47 expression, activity and/or signaling, or the interaction between CD47 and SIRPα. Very significantly, the CD47 antibodies of this disclosure do not generally cause a significant level of depletion or hemagglutination of human red blood cells, and surprisingly in many cases do not cause any depletion or hemagglutination of human red blood cells at all. Additionally, the CD47 antibodies of this disclosure have exhibited potent anti-tumor activities.

[9] In some examples, the CD47 antibodies of this disclosure each include (a) a variable heavy (VH) chain sequence that is at least 90% (e.g., at least 95%) identical to an amino acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 3, SEQ ID NO: 5, SEQ ID NO: 7, SEQ ID NO: 9, SEQ ID NO: 11, SEQ ID NO: 13, SEQ ID NO: 15, SEQ ID NO: 17, SEQ ID NO: 19, SEQ ID NO: 21, SEQ ID NO: 23, SEQ ID NO: 25, SEQ ID NO: 27, SEQ ID NO: 29, SEQ ID NO: 31, SEQ ID NO: 33, SEQ ID NO: 35, SEQ ID NO: 37, SEQ ID NO: 39, SEQ ID NO: 41, SEQ ID NO: 43, SEQ ID NO: 45, SEQ ID NO: 47, SEQ ID NO: 49, SEQ ID NO: 51, SEQ ID NO: 53, SEQ ID NO: 55, SEQ ID NO: 57, SEQ ID NO: 59, SEQ ID NO: 61, SEQ ID NO: 63, SEQ ID NO: 65, SEQ ID NO: 67, SEQ ID NO: 69, SEQ ID NO: 71, SEQ ID NO: 73, SEQ ID NO: 75, and SEQ ID NO: 77; and (b) a variable light (VL) chain sequence that is at least 90% (e.g., at least 95%) identical to an amino acid sequence selected from the group consisting of SEQ ID NO: 2, SEQ ID NO: 4, SEQ ID NO: 6, SEQ ID NO: 8, SEQ ID NO: 10, SEQ ID NO: 12, SEQ ID NO: 14, SEQ ID NO: 16, SEQ ID NO: 18, SEQ ID NO: 20, SEQ ID NO: 22, SEQ ID NO: 24, SEQ ID NO: 26, SEQ ID NO: 28, SEQ ID NO: 30, SEQ ID NO: 32, SEQ ID NO: 34, SEQ ID NO: 36, SEQ ID NO: 38, SEQ ID NO: 40, SEQ ID NO: 42,SEQ ID NO: 44, SEQ ID NO: 46, SEQ ID NO: 48, SEQ ID NO: 50, SEQ ID NO: 52, SEQ ID NO: 54, SEQ ID NO: 56,

SEQ ID NO: 58, SEQ ID NO: 60, SEQ ID NO: 62, SEQ ID NO: 64, SEQ ID NO: 66, SEQ ID NO: 68, SEQ ID NO: 70, SEQ ID NO: 72, SEQ ID NO: 74, SEQ ID NO: 76, and SEQ ID NO: 78.

[10] In some other examples, the CD47 antibodies of this disclosure each include paired VH/VL chain sequences that are at least 90% (e.g., at least 95%, 95%, 96, 97%, 98%, 99%, or 99.5%) identical to a pair of VH and VL amino acid sequences selected from the group consisting of SEQ ID NO: 1 and SEQ ID NO: 2 (i.e., 1A1), SEQ ID NO: 3 and SEQ ID NO: 4 (i.e., 1F8), SEQ ID NO: 5 and SEQ ID NO: 6 (i.e., 2A11), SEQ ID NO: 7 and SEQ ID NO: 8 (i.e., 2C2), SEQ ID NO: 9 and SEQ ID NO: 10 (i.e., 2D7), SEQ ID NO: 11 and SEQ ID NO: 12 (i.e., 2G4), SEQ ID NO: 13 and SEQ ID NO: 14 (i.e., 2G11), SEQ ID NO: 15 and SEQ ID NO: 16 (i.e., 6F4), SEQ ID NO: 17 and SEQ ID NO: 18 (i.e., 5H1), SEQ ID NO: 19 and SEQ ID NO: 20 (i.e., 5F6), SEQ ID NO: 21 and SEQ ID NO: 22 (i.e., 1F3), SEQ ID NO: 23 and SEQ ID NO: 24 (i.e., 2A4), SEQ ID NO: 25 and SEQ ID NO: 26 (i.e., 2B12), SEQ ID NO: 27 and SEQ ID NO: 28 (i.e., 13A11), SEQ ID NO: 29 and SEQ ID NO: 30 (i.e., 15E1), SEQ ID NO: 31 and SEQ ID NO: 32 (i.e., 13H3), SEQ ID NO: 33 and SEQ ID NO: 34 (i.e., 14A8), SEQ ID NO: 35 and SEQ ID NO: 36 (i.e., 16H3), SEQ ID NO: 37 and SEQ ID NO: 38 (i.e., 1A1), SEQ ID NO: 39 and SEQ ID NO: 40 (i.e., 1A1-A), SEQ ID NO: 41 and SEQ ID NO: 42 (i.e., 1A1-Q), SEQ ID NO: 43 and SEQ ID NO: 44 (i.e., 1A2), SEQ ID NO: 45 and SEQ ID NO: 46 (i.e., 1A8), SEQ ID NO: 47 and SEQ ID NO: 48 (i.e., 1B1), SEQ ID NO: 49 and SEQ ID NO: 50 (i.e., 1B2), SEQ ID NO: 51 and SEQ ID NO: 52 (i.e., 1H3), SEQ ID NO: 53 and SEQ ID NO: 54 (i.e., 1H3-Q), SEQ ID NO: 55 and SEQ ID NO: 56 (i.e., 1H3-A), SEQ ID NO: 57 and SEQ ID NO: 58 (i.e., 2A2), SEQ ID NO: 59 and SEQ ID NO: 60 (i.e., 2A3), SEQ ID NO: 61 and SEQ ID NO: 62 (i.e., 2A6), SEQ ID NO: 63 and SEQ ID NO: 64 (i.e., 2A10), SEQ ID NO: 65 and SEQ ID NO: 66 (i.e., 2B1), SEQ ID NO: 67 and SEQ ID NO: 68 (i.e., 2C6), SEQ ID NO: 69 and SEQ ID NO: 70 (i.e., 2E7), SEQ ID NO: 71 and SEQ ID NO: 72 (i.e., 2E9), SEQ ID NO: 73 and SEQ ID NO: 74 (i.e., 2F1), SEQ ID NO: 75 and SEQ ID NO: 76 (i.e., 2F3), and SEQ ID NO: 77 and SEQ ID NO: 78 (i.e., 34C5). In some instances, the CD47 antibodies of this disclosure each include a pair of VH and VL chain sequences selected from the group consisting of SEQ ID NO: 1 and SEQ ID NO: 2 (i.e., 1A1), SEQ ID NO: 3 and SEQ ID NO: 4 (i.e., 1F8), SEQ ID NO: 5 and SEQ ID NO: 6 (i.e., 2A11), SEQ ID NO: 7 and SEQ ID NO: 8 (i.e., 2C2), SEQ ID NO: 9 and SEQ ID NO: 10 (i.e., 2D7), SEQ ID NO: 11 and SEQ ID NO: 12 (i.e., 2G4), SEQ ID NO: 13 and SEQ ID NO: 14 (i.e., 2G11), SEQ ID NO: 15 and SEQ ID NO: 16 (i.e., 6F4), SEQ ID NO: 17 and SEQ ID NO: 18 (i.e., 5H1), SEQ ID NO: 19 and SEQ ID NO: 20 (i.e., 5F6), SEQ ID NO: 21 and SEQ ID NO:

22 (i.e., 1F3), SEQ ID NO: 23 and SEQ ID NO: 24 (i.e., 2A4), SEQ ID NO: 25 and SEQ ID NO: 26 (i.e., 2B12), SEQ ID NO: 27 and SEQ ID NO: 28 (i.e., 13A11), SEQ ID NO: 29 and SEQ ID NO: 30 (i.e., 15E1), SEQ ID NO: 31 and SEQ ID NO: 32 (i.e., 13H3), SEQ ID NO: 33 and SEQ ID NO: 34 (i.e., 14A8), SEQ ID NO: 35 and SEQ ID NO: 36 (i.e., 16H3), SEQ ID NO: 37 and SEQ ID NO: 38 (i.e., 1A1), SEQ ID NO: 39 and SEQ ID NO: 40 (i.e., 1A1-A), SEQ ID NO: 41 and SEQ ID NO: 42 (i.e., 1A1-Q), SEQ ID NO: 43 and SEQ ID NO: 44 (i.e., 1A2), SEQ ID NO: 45 and SEQ ID NO: 46 (i.e., 1A8), SEQ ID NO: 47 and SEQ ID NO: 48 (i.e., 1B1), SEQ ID NO: 49 and SEQ ID NO: 50 (i.e., 1B2), SEQ ID NO: 51 and SEQ ID NO: 52 (i.e., 1H3), SEQ ID NO: 53 and SEQ ID NO: 54 (i.e., 1H3-Q), SEQ ID NO: 55 and SEQ ID NO: 56 (i.e., 1H3-A), SEQ ID NO: 57 and SEQ ID NO: 58 (i.e., 2A2), SEQ ID NO: 59 and SEQ ID NO: 60 (i.e., 2A3), SEQ ID NO: 61 and SEQ ID NO: 62 (i.e., 2A6), SEQ ID NO: 63 and SEQ ID NO: 64 (i.e., 2A10), SEQ ID NO: 65 and SEQ ID NO: 66 (i.e., 2B1), SEQ ID NO: 67 and SEQ ID NO: 68 (i.e., 2C6), SEQ ID NO: 69 and SEQ ID NO: 70 (i.e., 2E7), SEQ ID NO: 71 and SEQ ID NO: 72 (i.e., 2E9), SEQ ID NO: 73 and SEQ ID NO: 74 (i.e., 2F1), SEQ ID NO: 75 and SEQ ID NO: 76 (i.e., 2F3), and SEQ ID NO: 77 and SEQ ID NO: 78 (i.e., 34C5).

[11] The CD47 antibodies of this disclosure can be chimeric or humanized. They can prevent or significantly reduce human CD47 from interacting with SIRPα, or promotes macrophage-mediated phagocytosis of a CD47-expressing cell.

[12] The CD47 antibodies of this disclosure do not cause a significant or noticeable level of hemagglutination or depletion of red blood cells, and in many cases they do not cause hemagglutination or depletion of red blood cells at all.

[13] In another example, the present disclosure provides isolated bispecific monoclonal antibodies. Each of such isolated bispecific monoclonal antibodies comprises a first arm and a second arm, wherein the first arm comprises a first monoclonal antibody or immunologically active fragment thereof as described above which binds human CD47, and the second arm comprise a second monoclonal antibody that does not bind human CD47.

[14] In some examples, the second arm in the isolated bispecific monoclonal antibodies binds to a cancer cell.

[15] In some other examples, the bispecific monoclonal antibodies inhibit interaction between human CD47 and human SIRPα.

[16] In still another example, the present disclosure provides pharmaceutical compositions each containing one of the CD47 antibodies of this disclosure or an isolated bispecific monoclonal antibody of this disclosure, and a pharmaceutically acceptable carrier or excipient.

[17] As used herein, the term "pharmaceutically acceptable carrier or excipient" refers to a carrier or an excipient that is useful for preparing a pharmaceutical composition or formulation that is generally safe, non-toxic, and neither biologically nor otherwise undesirable. A carrier or excipient employed is typically one suitable for administration to human subjects or other mammals. In making the compositions, the active ingredient is usually mixed with, diluted by, or enclosed with a carrier or excipient. When the carrier or excipient serves as a diluent, it can be a solid, semi-solid, or liquid material, which acts as a vehicle, carrier, or medium for the active ingredient of the antibody.

[18] Also within the scope of the present disclosure is a method for treating a disease in a human subject in need thereof, and the method includes administering to the subject a therapeutically effective amount of a CD47 antibody of this disclosure, a bispecific monoclonal antibody of this disclosure, or a pharmaceutical composition of this disclosure, and the disease is a cancer, a fibrotic disease, or any disease related to inhibition of phagocytosis. In some instance, the cancer can be selected from the group consisting of ovarian cancer, colon cancer, breast cancer, lung cancer, head and neck cancer, bladder cancer, colorectal cancer, pancreatic cancer, non-Hodgkin's lymphoma, acute lymphocytic leukemia, chronic lymphocytic leukemia, acute myeloid leukemia, chronic myelogenous leukemia, hairy cell leukemia (HCL), T-cell prolymphocytic leukemia (T-PLL), large granular lymphocytic leukemia, adult T-cell leukemia, multiple myeloma, melanoma, leiomyoma, leiomyosarcoma, glioma, glioblastoma, myelomas, monocytic leukemias, B-cell derived leukemias, T-cell derived leukemias, B-cell derived lymphomas, T-cell derived lymphomas, endometrial cancer, kidney cancer, melanoma, prostate cancer, thyroid cancer, cervical cancer, gastric cancer, liver cancer, and solid tumors; whereas the fibrotic disease can be selected from the group consisting of myocardial infarction, angina, osteoarthritis, pulmonary fibrosis, asthma, cystic fibrosis, bronchitis, and asthma. Examples of solid tumors include, e.g., endometrial cancer, thyroid cancer, cervical cancer, gastric cancer, breast tumors, ovarian tumors, lung tumors, pancreatic tumors, prostate tumors, melanoma tumors, colorectal tumors, lung tumors, head and neck tumors, bladder tumors, esophageal

tumors, liver tumors, and kidney tumors, and neuroblastic-derived CNS tumors. The disease related to inhibition of phagocytosis can be a cardiovascular disease (e.g., atherosclerosis, stroke, hypertensive heart disease, rheumatic heart disease, cardiomyopathy, heart arrhythmia, congenital heart disease, valvular heart disease, carditis, aortic aneurysms, peripheral artery disease, or venous thrombosis).

[19] As used herein, the term "effective amount" refers to that amount of a CD47 antibody sufficient or required to effect treatment, prognosis or diagnosis of a disease associated with CD47 dependent signaling, as described herein, when administered to a subject. Therapeutically effective amounts of antibodies provided herein, when used alone or in combination, will vary depending upon the relative activity of the antibodies (e.g., promoting macrophage mediated phagocytosis of cancer cells expressing CD47) and depending upon the subject and disease condition being treated, the weight and age of the subject, the severity of the disease condition, the manner of administration and the like, which can readily be determined by one of ordinary skill in the art.

[20] As used herein, the term "isolated" preceding a CD47 antibody of this disclosure means that the antibody is substantially free of other cellular material. In one example, an isolated antibody is substantially free of other proteins from the same species. In another example, an isolated antibody is expressed by a cell from a different species and is substantially free of other proteins from the different species. A protein may be rendered substantially free of naturally associated components (or components associated with the cellular expression system used to produce the antibody) by isolation, using protein purification techniques well known in the art. In one example, the antibodies, or antigen binding fragments, of the disclosure are isolated.

[21] Still within the scope of this disclosure are fusion proteins each comprising a first amino acid sequence and a second amino acid sequence, wherein the first amino acid sequence is SEQ ID NO: 1, SEQ ID NO: 3, SEQ ID NO: 5, SEQ ID NO: 7, SEQ ID NO: 9, SEQ ID NO: 11, SEQ ID NO: 13, SEQ ID NO: 15, SEQ ID NO: 17, SEQ ID NO: 19, SEQ ID NO: 21, SEQ ID NO: 23, SEQ ID NO: 25, SEQ ID NO: 27, SEQ ID NO: 29, SEQ ID NO: 31, SEQ ID NO: 33, SEQ ID NO: 35, SEQ ID NO: 37, SEQ ID NO: 39, SEQ ID NO: 41, SEQ ID NO: 43, SEQ ID NO: 45, SEQ ID NO: 47, SEQ ID NO: 49, SEQ ID NO: 51, SEQ ID NO: 53, SEQ ID NO: 55, SEQ ID NO: 57, SEQ ID NO: 59, SEQ ID NO: 61, SEQ ID NO: 63, SEQ ID NO: 65, SEQ ID NO: 67, SEQ ID NO: 69, SEQ ID NO: 71, SEQ ID NO: 73,

SEQ ID NO: 75, or SEQ ID NO: 77, or an amino acid sequence that is at least 90% (e.g., at least 95%) identical thereto; and the second amino acid sequence is SEQ ID NO: 2, SEQ ID NO: 4, SEQ ID NO: 6, SEQ ID NO: 8, SEQ ID NO: 10, SEQ ID NO: 12, SEQ ID NO: 14, SEQ ID NO: 16, SEQ ID NO: 18, SEQ ID NO: 20, SEQ ID NO: 22, SEQ ID NO: 24, SEQ ID NO: 26, SEQ ID NO: 28, SEQ ID NO: 30, SEQ ID NO: 32, SEQ ID NO: 34, SEQ ID NO: 36, SEQ ID NO: 38, SEQ ID NO: 40, SEQ ID NO: 42, SEQ ID NO: 44, SEQ ID NO: 46, SEQ ID NO: 48, SEQ ID NO: 50, SEQ ID NO: 52, SEQ ID NO: 54, SEQ ID NO: 56, SEQ ID NO: 58, SEQ ID NO: 60, SEQ ID NO: 62, SEQ ID NO: 64, SEQ ID NO: 66, SEQ ID NO: 68, SEQ ID NO: 70, SEQ ID NO: 72, SEQ ID NO: 74, SEQ ID NO: 76, or SEQ ID NO: 78, or an amino acid sequence that is at least 90% (e.g., at least 95%) identical thereto.

[22] In some examples, a fusion protein of this disclosure includes a combination of the first amino acid sequence and the second amino acid sequence, and the combination of these two amino acid sequences is SEQ ID NO: 1 and SEQ ID NO: 2 (i.e., 1A1), SEQ ID NO: 3 and SEQ ID NO: 4 (i.e., 1F8), SEQ ID NO: 5 and SEQ ID NO: 6 (i.e., 2A11), SEQ ID NO: 7 and SEQ ID NO: 8 (i.e., 2C2), SEQ ID NO: 9 and SEQ ID NO: 10 (i.e., 2D7), SEQ ID NO: 11 and SEQ ID NO: 12 (i.e., 2G4), SEQ ID NO: 13 and SEQ ID NO: 14 (i.e., 2G11), SEQ ID NO: 15 and SEQ ID NO: 16 (i.e., 6F4), SEQ ID NO: 17 and SEQ ID NO: 18 (i.e., 5H1), SEQ ID NO: 19 and SEQ ID NO: 20 (i.e., 5F6), SEQ ID NO: 21 and SEQ ID NO: 22 (i.e., 1F3), SEQ ID NO: 23 and SEQ ID NO: 24 (i.e., 2A4), SEQ ID NO: 25 and SEQ ID NO: 26 (i.e., 2B12), SEQ ID NO: 27 and SEQ ID NO: 28 (i.e., 13A11), SEQ ID NO: 29 and SEQ ID NO: 30 (i.e., 15E1), SEQ ID NO: 31 and SEQ ID NO: 32 (i.e., 13H3), SEQ ID NO: 33 and SEQ ID NO: 34 (i.e., 14A8), SEQ ID NO: 35 and SEQ ID NO: 36 (i.e., 16H3), SEQ ID NO: 37 and SEQ ID NO: 38 (i.e., 1A1), SEQ ID NO: 39 and SEQ ID NO: 40 (i.e., 1A1-A), SEQ ID NO: 41 and SEQ ID NO: 42 (i.e., 1A1-Q), SEQ ID NO: 43 and SEQ ID NO: 44 (i.e., 1A2), SEQ ID NO: 45 and SEQ ID NO: 46 (i.e., 1A8), SEQ ID NO: 47 and SEQ ID NO: 48 (i.e., 1B1), SEQ ID NO: 49 and SEQ ID NO: 50 (i.e., 1B2), SEQ ID NO: 51 and SEQ ID NO: 52 (i.e., 1H3), SEQ ID NO: 53 and SEQ ID NO: 54 (i.e., 1H3-Q), SEQ ID NO: 55 and SEQ ID NO: 56 (i.e., 1H3-A), SEQ ID NO: 57 and SEQ ID NO: 58 (i.e., 2A2), SEQ ID NO: 59 and SEQ ID NO: 60 (i.e., 2A3), SEQ ID NO: 61 and SEQ ID NO: 62 (i.e., 2A6), SEQ ID NO: 63 and SEQ ID NO: 64 (i.e., 2A10), SEQ ID NO: 65 and SEQ ID NO: 66 (i.e., 2B1), SEQ ID NO: 67 and SEQ ID NO: 68 (i.e., 2C6), SEQ ID NO: 69 and SEQ ID NO: 70 (i.e., 2E7), SEQ ID NO: 71 and SEQ ID NO: 72 (i.e., 2E9), SEQ ID NO: 73 and SEQ ID NO: 74 (i.e., 2F1), SEQ ID NO: 75 and SEQ ID NO: 76 (i.e., 2F3), SEQ ID NO: 77 and SEQ ID NO: 78 (i.e., 34C5),

or a combination that is at least 90% (e.g., at least 95%) identical thereto for each of the first and second amino acid sequences.

[23] In some other examples, a fusion protein of this disclosure includes a combination of the first amino acid sequence and the second amino acid sequence, and the combination of these two amino acid sequences is SEQ ID NO: 1 and SEQ ID NO: 2 (i.e., 1A1), SEQ ID NO: 3 and SEQ ID NO: 4 (i.e., 1F8), SEQ ID NO: 5 and SEQ ID NO: 6 (i.e., 2A11), SEQ ID NO: 7 and SEQ ID NO: 8 (i.e., 2C2), SEQ ID NO: 9 and SEQ ID NO: 10 (i.e., 2D7), SEQ ID NO: 11 and SEQ ID NO: 12 (i.e., 2G4), SEQ ID NO: 13 and SEQ ID NO: 14 (i.e., 2G11), SEQ ID NO: 15 and SEQ ID NO: 16 (i.e., 6F4), SEQ ID NO: 17 and SEQ ID NO: 18 (i.e., 5H1), SEQ ID NO: 19 and SEQ ID NO: 20 (i.e., 5F6), SEQ ID NO: 21 and SEQ ID NO: 22 (i.e., 1F3), SEQ ID NO: 23 and SEQ ID NO: 24 (i.e., 2A4), SEQ ID NO: 25 and SEQ ID NO: 26 (i.e., 2B12), SEQ ID NO: 27 and SEQ ID NO: 28 (i.e., 13A11), SEQ ID NO: 29 and SEQ ID NO: 30 (i.e., 15E1), SEQ ID NO: 31 and SEQ ID NO: 32 (i.e., 13H3), SEQ ID NO: 33 and SEQ ID NO: 34 (i.e., 14A8), SEQ ID NO: 35 and SEQ ID NO: 36 (i.e., 16H3), SEQ ID NO: 37 and SEQ ID NO: 38 (i.e., 1A1), SEQ ID NO: 39 and SEQ ID NO: 40 (i.e., 1A1-A), SEQ ID NO: 41 and SEQ ID NO: 42 (i.e., 1A1-Q), SEQ ID NO: 43 and SEQ ID NO: 44 (i.e., 1A2), SEQ ID NO: 45 and SEQ ID NO: 46 (i.e., 1A8), SEQ ID NO: 47 and SEQ ID NO: 48 (i.e., 1B1), SEQ ID NO: 49 and SEQ ID NO: 50 (i.e., 1B2), SEQ ID NO: 51 and SEQ ID NO: 52 (i.e., 1H3), SEQ ID NO: 53 and SEQ ID NO: 54 (i.e., 1H3-Q), SEQ ID NO: 55 and SEQ ID NO: 56 (i.e., 1H3-A), SEQ ID NO: 57 and SEQ ID NO: 58 (i.e., 2A2), SEQ ID NO: 59 and SEQ ID NO: 60 (i.e., 2A3), SEQ ID NO: 61 and SEQ ID NO: 62 (i.e., 2A6), SEQ ID NO: 63 and SEQ ID NO: 64 (i.e., 2A10), SEQ ID NO: 65 and SEQ ID NO: 66 (i.e., 2B1), SEQ ID NO: 67 and SEQ ID NO: 68 (i.e., 2C6), SEQ ID NO: 69 and SEQ ID NO: 70 (i.e., 2E7), SEQ ID NO: 71 and SEQ ID NO: 72 (i.e., 2E9), SEQ ID NO: 73 and SEQ ID NO: 74 (i.e., 2F1), SEQ ID NO: 75 and SEQ ID NO: 76 (i.e., 2F3), or SEQ ID NO: 77 and SEQ ID NO: 78 (i.e., 34C5).

[24] In still some other examples, a fusion protein of this disclosure can further include an additional protein – in addition to the first and second amino acid sequences. The additional protein is an antibody or a cytokine.

[25] In yet still some other examples, a fusion protein of this disclosure can be conjugated with a small-molecule therapeutic agent (e.g., anti-cancer or anti-inflammation agent) or a marker (e.g., a biomarker or fluorescent marker).

[26] In yet another example, the present disclosure provides immunodominant epitopes encoded by the CD47 gene comprising a recombinant protein containing conformationally a TNMEAQ loop (residues 26-31), T34, E35, L74, and an LTR hinge (residues 101-103) of CD47.

[27] In yet still another example, the present disclosure provides biological molecules that specifically bind to a conformational epitope having an amino acid sequence comprising a TNMEAQ loop (residues 26-31), T34, E35, L74, and an LTR hinge (residues 101-103) of CD47, wherein the antibody can specifically bind to CD47.

[28] As used herein, the term "biological molecules" is meant to include synthetic antibodies (monoclonal or bispecific), peptides, and biomimetic molecules. The term "biomimetic molecules" refers to molecules which are designed or developed to have structures or properties similar to or resembling those of naturally occurring large compounds such as proteins or nucleotides and which have a molecular weight of, e.g., at least 3,000, at least 5,000, or at least 10,000.

[29] All references cited herein are incorporated by reference in their entirety.

BRIEF DESCRIPTIONS OF THE DRAWINGS

[30] Fig. 1 shows dose-dependent response of CD47 antibodies binding to monomeric CD47-ECD.

[31] Fig. 2a and Fig. 2b show dose-dependent response of CD47 antibodies binding to dimeric CD47-ECD.

[32] Fig. 3a, Fig. 3b, and Fig. 3c dose-dependent response of CD47 antibodies blocking the binding of CD47 to SIRPα.

What Is Claimed Is:

1. An isolated monoclonal antibody or immunologically active fragment thereof that binds to human CD47, comprising:

a variable heavy (VH) chain sequence that is at least 95% identical to an amino acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 3, SEQ ID NO: 5, SEQ ID NO: 7, SEQ ID NO: 9, SEQ ID NO: 11, SEQ ID NO: 13, SEQ ID NO: 15, SEQ ID NO: 17, SEQ ID NO: 19, SEQ ID NO: 21, SEQ ID NO: 23, SEQ ID NO: 25, SEQ ID NO: 27, SEQ ID NO: 29, SEQ ID NO: 31, SEQ ID NO: 33, SEQ ID NO: 35, SEQ ID NO: 37, SEQ ID NO: 39, SEQ ID NO: 41, SEQ ID NO: 43, SEQ ID NO: 45, SEQ ID NO: 47, SEQ ID NO: 49, SEQ ID NO: 51, SEQ ID NO: 53, SEQ ID NO: 55, SEQ ID NO: 57, SEQ ID NO: 59, SEQ ID NO: 61, SEQ ID NO: 63, SEQ ID NO: 65, SEQ ID NO: 67, SEQ ID NO: 69, SEQ ID NO: 71, SEQ ID NO: 73, SEQ ID NO: 75, and SEQ ID NO: 77; and

a variable light (VL) chain sequence that is at least 95% identical to an amino acid sequence selected from the group consisting of SEQ ID NO: 2, SEQ ID NO: 4, SEQ ID NO: 6, SEQ ID NO: 8, SEQ ID NO: 10, SEQ ID NO: 12, SEQ ID NO: 14, SEQ ID NO: 16, SEQ ID NO: 18, SEQ ID NO: 20, SEQ ID NO: 22, SEQ ID NO: 24, SEQ ID NO: 26, SEQ ID NO: 28, SEQ ID NO: 30, SEQ ID NO: 32, SEQ ID NO: 34, SEQ ID NO: 36, SEQ ID NO: 38, SEQ ID NO: 40, SEQ ID NO: 42, SEQ ID NO: 44, SEQ ID NO: 46, SEQ ID NO: 48, SEQ ID NO: 50, SEQ ID NO: 52, SEQ ID NO: 54, SEQ ID NO: 56, SEQ ID NO: 58, SEQ ID NO: 60, SEQ ID NO: 62, SEQ ID NO: 64, SEQ ID NO: 66, SEQ ID NO: 68, SEQ ID NO: 70, SEQ ID NO: 72, SEQ ID NO: 74, SEQ ID NO: 76, and SEQ ID NO: 78.

2. The isolated monoclonal antibody or immunologically active fragment thereof of claim 1, comprising a VH/VL pair, wherein the VH/VL pair comprises VH and VL chain sequences at least 95% identical to a pair of VH and VL amino acid sequences selected from the group consisting of SEQ ID NO: 1 and SEQ ID NO: 2, SEQ ID NO: 3 and SEQ ID NO: 4, SEQ ID NO: 5 and SEQ ID NO: 6, SEQ ID NO: 7 and SEQ ID NO: 8, SEQ ID NO: 9 and SEQ ID NO: 10, SEQ ID NO: 11 and SEQ ID NO: 12, SEQ ID NO: 13 and SEQ ID NO: 14, SEQ ID NO: 15 and SEQ ID NO: 16, SEQ ID NO: 17 and SEQ ID NO: 18, SEQ ID NO: 19 and SEQ ID NO: 20, SEQ ID NO: 21 and SEQ ID NO: 22, SEQ ID NO: 23 and SEQ ID NO: 24, SEQ ID NO: 25 and SEQ ID NO: 26, SEQ ID NO: 27 and SEQ ID NO: 28, SEQ ID NO: 29 and SEQ ID

NO: 30, SEQ ID NO: 31 and SEQ ID NO: 32, SEQ ID NO: 33 and SEQ ID NO: 34, SEQ ID NO: 35 and SEQ ID NO: 36, SEQ ID NO: 37 and SEQ ID NO: 38, SEQ ID NO: 39 and SEQ ID NO: 40, SEQ ID NO: 41 and SEQ ID NO: 42, SEQ ID NO: 43 and SEQ ID NO: 44, SEQ ID NO: 45 and SEQ ID NO: 46, SEQ ID NO: 47 and SEQ ID NO: 48, SEQ ID NO: 49 and SEQ ID NO: 50, SEQ ID NO: 51 and SEQ ID NO: 52, SEQ ID NO: 53 and SEQ ID NO: 54, SEQ ID NO: 55 and SEQ ID NO: 56, SEQ ID NO: 57 and SEQ ID NO: 58, SEQ ID NO: 59 and SEQ ID NO: 60, SEQ ID NO: 61 and SEQ ID NO: 62, SEQ ID NO: 63 and SEQ ID NO: 64, SEQ ID NO: 65 and SEQ ID NO: 66, SEQ ID NO: 67 and SEQ ID NO: 68, SEQ ID NO: 69 and SEQ ID NO: 70, SEQ ID NO: 71 and SEQ ID NO: 72, SEQ ID NO: 73 and SEQ ID NO: 74, SEQ ID NO: 75 and SEQ ID NO: 76, and SEQ ID NO: 77 and SEQ ID NO: 78.

3. The isolated monoclonal antibody or immunologically active fragment thereof of claim 1, comprising a VH/VL pair, wherein the VH/VL pair comprises VH and VL chain sequences selected from the group consisting of SEQ ID NO: 1 and SEQ ID NO: 2, SEQ ID NO: 3 and SEQ ID NO: 4, SEQ ID NO: 5 and SEQ ID NO: 6, SEQ ID NO: 7 and SEQ ID NO: 8 , SEQ ID NO: 9 and SEQ ID NO: 10, SEQ ID NO: 11 and SEQ ID NO: 12, SEQ ID NO: 13 and SEQ ID NO: 14, SEQ ID NO: 15 and SEQ ID NO: 16, SEQ ID NO: 17 and SEQ ID NO: 18, SEQ ID NO: 19 and SEQ ID NO: 20, SEQ ID NO: 21 and SEQ ID NO: 22, SEQ ID NO: 23 and SEQ ID NO: 24, SEQ ID NO: 25 and SEQ ID NO: 26, SEQ ID NO: 27 and SEQ ID NO: 28, SEQ ID NO: 29 and SEQ ID NO: 30, SEQ ID NO: 31 and SEQ ID NO: 32, SEQ ID NO: 33 and SEQ ID NO: 34, SEQ ID NO: 35 and SEQ ID NO: 36, SEQ ID NO: 37 and SEQ ID NO: 38, SEQ ID NO: 39 and SEQ ID NO: 40, SEQ ID NO: 41 and SEQ ID NO: 42, SEQ ID NO: 43 and SEQ ID NO: 44, SEQ ID NO: 45 and SEQ ID NO: 46, SEQ ID NO: 47 and SEQ ID NO: 48, SEQ ID NO: 49 and SEQ ID NO: 50, SEQ ID NO: 51 and SEQ ID NO: 52, SEQ ID NO: 53 and SEQ ID NO: 54, SEQ ID NO: 55 and SEQ ID NO: 56, SEQ ID NO: 57 and SEQ ID NO: 58, SEQ ID NO: 59 and SEQ ID NO: 60, SEQ ID NO: 61 and SEQ ID NO: 62, SEQ ID NO: 63 and SEQ ID NO: 64, SEQ ID NO: 65 and SEQ ID NO: 66, SEQ ID NO: 67 and SEQ ID NO: 68, SEQ ID NO: 69 and SEQ ID NO: 70, SEQ ID NO: 71 and SEQ ID NO: 72, SEQ ID NO: 73 and SEQ ID NO: 74, SEQ ID NO: 75 and SEQ ID NO: 76, and SEQ ID NO: 77 and SEQ ID NO: 78.

4. The isolated monoclonal antibody or immunologically active fragment thereof of claim 1, wherein the isolated monoclonal antibody or immunologically active fragment thereof is chimeric or humanized.
5. The isolated monoclonal antibody or immunologically active fragment thereof of claim 1, wherein the isolated monoclonal antibody or immunologically active fragment thereof prevents human CD47 from interacting with signal-regulatory-protein α (SIRPα).
6. The isolated monoclonal antibody or immunologically active fragment thereof of claim 1, wherein the isolated monoclonal antibody or immunologically active fragment thereof promotes macrophage-mediated phagocytosis of a CD47-expressing cell.
7. The isolated monoclonal antibody or immunologically active fragment thereof of claim 1, wherein the isolated monoclonal antibody or immunologically active fragment thereof does not cause a significant level of hemagglutination or depletion of red blood cells.
8. The isolated monoclonal antibody or immunologically active fragment thereof of claim 1, wherein the isolated monoclonal antibody or immunologically active fragment thereof does not cause hemagglutination or depletion of red blood cells.
9. An isolated bispecific monoclonal antibody comprising a first arm and a second arm, wherein the first arm comprises a first monoclonal antibody or immunologically active fragment thereof of any of claims 1-8 which binds human CD47, and the second arm comprise a second monoclonal antibody that does not bind human CD47.
10. The bispecific monoclonal antibody of claim 9, wherein the second arm binds to a cancer cell.
11. The bispecific monoclonal antibody of claim 8 or 9, wherein the bispecific monoclonal antibody inhibits interaction between human CD47 and human SIRPα.
12. A pharmaceutical composition comprising an isolated monoclonal antibody or immunologically active fragment thereof of any of claims 1-8 or a bispecific monoclonal antibody of any of claims 9-11, and a pharmaceutically acceptable carrier.
13. Use of an isolated monoclonal antibody or immunologically active fragment thereof of any of claims 1-8 or a bispecific monoclonal antibody of any of claims 9-11, or a pharmaceutical composition of claim 11 in the manufacture of a medicament for

treating cancer, a fibrotic disease, a disease related to inhibition of phagocytosis, or a disease related to platelet aggregation.

14. The use of claim 13, wherein the cancer is selected from the group consisting of: ovarian cancer, colon cancer, breast cancer, lung cancer, head and neck cancer, bladder cancer, colorectal cancer, pancreatic cancer, non-Hodgkin's lymphoma, acute lymphocytic leukemia, chronic lymphocytic leukemia, acute myeloid leukemia, chronic myelogenous leukemia, hairy cell leukemia (HCL), T-cell prolymphocytic leukemia (T-PLL), large granular lymphocytic leukemia, adult T-cell leukemia, multiple myeloma, melanoma, leiomyoma, leiomyosarcoma, glioma, glioblastoma, myelomas, monocytic leukemias, B-cell derived leukemias, T-cell derived leukemias, B-cell derived lymphomas, T-cell derived lymphomas, endometrial cancer, kidney cancer, melanoma, prostate cancer, thyroid cancer, cervical cancer, gastric cancer, liver cancer, and solid tumors; the fibrotic disease is selected from the group consisting of: myocardial infarction, angina, osteoarthritis, pulmonary fibrosis, asthma, cystic fibrosis, bronchitis, and asthma; the disease related to inhibition of phagocytosis is a cardiovascular disease; the disease related to platelet aggregation is Glanzmann Thrombasthenia, prolonged bleeding time, immune thrombocytopenia (ITP), von Willebrand disease (vWD).

15. The use of claim 14, wherein the cardiovascular disease is selected from the group consisting of atherosclerosis, stroke, hypertensive heart disease, rheumatic heart disease, cardiomyopathy, heart arrhythmia, congenital heart disease, valvular heart disease, carditis, aortic aneurysms, peripheral artery disease, and venous thrombosis.

16. A fusion protein comprising a first amino acid sequence and a second amino acid sequence, wherein the first amino acid sequence is SEQ ID NO: 1, SEQ ID NO: 3, SEQ ID NO: 5, SEQ ID NO: 7, SEQ ID NO: 9, SEQ ID NO: 11, SEQ ID NO: 13, SEQ ID NO: 15, SEQ ID NO: 17, SEQ ID NO: 19, SEQ ID NO: 21, SEQ ID NO: 23, SEQ ID NO: 25, SEQ ID NO: 27, SEQ ID NO: 29, SEQ ID NO: 31, SEQ ID NO: 33, SEQ ID NO: 35, SEQ ID NO: 37, SEQ ID NO: 39, SEQ ID NO: 41, SEQ ID NO: 43, SEQ ID NO: 45, SEQ ID NO: 47, SEQ ID NO: 49, SEQ ID NO: 51, SEQ ID NO: 53, SEQ ID NO: 55, SEQ ID NO: 57, SEQ ID NO: 59, SEQ ID NO: 61, SEQ ID NO: 63, SEQ ID NO: 65, SEQ ID NO: 67, SEQ ID NO: 69, SEQ ID NO: 71, SEQ ID NO:

73, SEQ ID NO: 75, or SEQ ID NO: 77, or an amino acid sequence that is at least 95% identical thereto; and the second amino acid sequence is SEQ ID NO: 2, SEQ ID NO: 4, SEQ ID NO: 6, SEQ ID NO: 8, SEQ ID NO: 10, SEQ ID NO: 12, SEQ ID NO: 14, SEQ ID NO: 16, SEQ ID NO: 18, SEQ ID NO: 20, SEQ ID NO: 22, SEQ ID NO: 24, SEQ ID NO: 26, SEQ ID NO: 28, SEQ ID NO: 30, SEQ ID NO: 32, SEQ ID NO: 34, SEQ ID NO: 36, SEQ ID NO: 38, SEQ ID NO: 40, SEQ ID NO: 42, SEQ ID NO: 44, SEQ ID NO: 46, SEQ ID NO: 48, SEQ ID NO: 50, SEQ ID NO: 52, SEQ ID NO: 54, SEQ ID NO: 56, SEQ ID NO: 58, SEQ ID NO: 60, SEQ ID NO: 62, SEQ ID NO: 64, SEQ ID NO: 66, SEQ ID NO: 68, SEQ ID NO: 70, SEQ ID NO: 72, SEQ ID NO: 74, SEQ ID NO: 76, or SEQ ID NO: 78, or an amino acid sequence that is at least 95% identical thereto.

17. The fusion protein of claim 16, comprising a combination of the first amino acid sequence and the second amino acid sequence, and the combination is SEQ ID NO: 1 and SEQ ID NO: 2, SEQ ID NO: 3 and SEQ ID NO: 4, SEQ ID NO: 5 and SEQ ID NO: 6, SEQ ID NO: 7 and SEQ ID NO: 8, SEQ ID NO: 9 and SEQ ID NO: 10, SEQ ID NO: 11 and SEQ ID NO: 12, SEQ ID NO: 13 and SEQ ID NO: 14, SEQ ID NO: 15 and SEQ ID NO: 16, SEQ ID NO: 17 and SEQ ID NO: 18, SEQ ID NO: 19 and SEQ ID NO: 20, SEQ ID NO: 21 and SEQ ID NO: 22, SEQ ID NO: 23 and SEQ ID NO: 24, SEQ ID NO: 25 and SEQ ID NO: 26, SEQ ID NO: 27 and SEQ ID NO: 28, SEQ ID NO: 29 and SEQ ID NO: 30, SEQ ID NO: 31 and SEQ ID NO: 32, SEQ ID NO: 33 and SEQ ID NO: 34, SEQ ID NO: 35 and SEQ ID NO: 36, SEQ ID NO: 37 and SEQ ID NO: 38, SEQ ID NO: 39 and SEQ ID NO: 40, SEQ ID NO: 41 and SEQ ID NO: 42, SEQ ID NO: 43 and SEQ ID NO: 44, SEQ ID NO: 45 and SEQ ID NO: 46, SEQ ID NO: 47 and SEQ ID NO: 48, SEQ ID NO: 49 and SEQ ID NO: 50, SEQ ID NO: 51 and SEQ ID NO: 52, SEQ ID NO: 53 and SEQ ID NO: 54, SEQ ID NO: 55 and SEQ ID NO: 56, SEQ ID NO: 57 and SEQ ID NO: 58, SEQ ID NO: 59 and SEQ ID NO: 60, SEQ ID NO: 61 and SEQ ID NO: 62, SEQ ID NO: 63 and SEQ ID NO: 64, SEQ ID NO: 65 and SEQ ID NO: 66, SEQ ID NO: 67 and SEQ ID NO: 68, SEQ ID NO: 69 and SEQ ID NO: 70, SEQ ID NO: 71 and SEQ ID NO: 72, SEQ ID NO: 73 and SEQ ID NO: 74, SEQ ID NO: 75 and SEQ ID NO: 76, or SEQ ID NO: 77 and SEQ ID NO: 78, or a combination that is at least 95% identical thereto for each of the first and second amino acid sequences.

18. The fusion protein of claim 16 or 17, comprising a combination of the first amino acid sequence and the second amino acid sequence, and the combination is SEQ ID NO: 1 and SEQ ID NO: 2, SEQ ID NO: 3 and SEQ ID NO: 4, SEQ ID NO: 5 and SEQ ID NO: 6, SEQ ID NO: 7 and SEQ ID NO: 8, SEQ ID NO: 9 and SEQ ID NO: 10, SEQ ID NO: 11 and SEQ ID NO: 12, SEQ ID NO: 13 and SEQ ID NO: 14, SEQ ID NO: 15 and SEQ ID NO: 16, SEQ ID NO: 17 and SEQ ID NO: 18, SEQ ID NO: 19 and SEQ ID NO: 20, SEQ ID NO: 21 and SEQ ID NO: 22, SEQ ID NO: 23 and SEQ ID NO: 24, or SEQ ID NO: 25 and SEQ ID NO: 26, SEQ ID NO: 27 and SEQ ID NO: 28, SEQ ID NO: 29 and SEQ ID NO: 30, SEQ ID NO: 31 and SEQ ID NO: 32, SEQ ID NO: 33 and SEQ ID NO: 34, SEQ ID NO: 35 and SEQ ID NO: 36 (16H3), SEQ ID NO: 37 and SEQ ID NO: 38, SEQ ID NO: 39 and SEQ ID NO: 40, SEQ ID NO: 41 and SEQ ID NO: 42, SEQ ID NO: 43 and SEQ ID NO: 44, SEQ ID NO: 45 and SEQ ID NO: 46, SEQ ID NO: 47 and SEQ ID NO: 48, SEQ ID NO: 49 and SEQ ID NO: 50, SEQ ID NO: 51 and SEQ ID NO: 52, SEQ ID NO: 53 and SEQ ID NO: 54, SEQ ID NO: 55 and SEQ ID NO: 56, SEQ ID NO: 57 and SEQ ID NO: 58, SEQ ID NO: 59 and SEQ ID NO: 60, SEQ ID NO: 61 and SEQ ID NO: 62, SEQ ID NO: 63 and SEQ ID NO: 64, SEQ ID NO: 65 and SEQ ID NO: 66, SEQ ID NO: 67 and SEQ ID NO: 68, SEQ ID NO: 69 and SEQ ID NO: 70, SEQ ID NO: 71 and SEQ ID NO: 72, SEQ ID NO: 73 and SEQ ID NO: 74, SEQ ID NO: 75 and SEQ ID NO: 76, or SEQ ID NO: 77 and SEQ ID NO: 78.
19. The fusion protein of any of claims 16-18, further comprising an additional protein in addition to the first and second amino acid sequences.
20. The fusion protein of claim 19, wherein the additional protein is an antibody or a cytokine.
21. The fusion protein of any of claims 16-20, wherein the fusion protein is conjugated with a small-molecule therapeutic agent or a marker.
22. The fusion protein of claim 21 wherein the small molecule therapeutic agent is an anti-cancer or anti-inflammation agent; and the marker is a biomarker or fluorescent marker.
23. An immunodominant epitope encoded by the CD47 gene comprising a recombinant protein containing conformationally a TNMEAQ loop (residues 26-31), T34, E35, L74, and an LTR hinge (residues 101-103) of CD47.

24. A biological molecule that specifically binds to a conformational epitope having an amino acid sequence comprising a TNMEAQ loop (residues 26-31), T34, E35, L74, and an LTR hinge (residues 101-103) of CD47, wherein the antibody can specifically bind to CD47.