Figure S1. Gene sequence of TaKE1-Fc. Notably, four variable fragments from three different antibody clones were connected to form a circularly tetramerized structure and fused to a human Fc region. TaKE-Fc, Fc-fused T cell and natural killer cell engager; red shadow, restriction enzyme site; black & underline, signal peptide (human  $\beta$ -lactalbumin); light green, hOL; blue, h5H; sky blue, h5L; orange, 3GH; yellow, 3GL; green, hOH; pink shadow, HRV3C protease recognition site; purple shadow, hinge region; gray shadow, human IgG1 Fc; underline in hinge, mutation H237Y.

## Gene sequence of TaKE1-Fc

GAATTCGCCACCATGAAATGGGTCACCTTTATCTCCCTGCTGTTCCTGTTCTCCTCCGCCTACTCCGACATCCAGATGACCCAGTCC CCCTCCAGCCTGTCTGCCTCTGTGGGCGACAGAGTGACAATTACCTGCTCCGCCTCCTCCGTGTCCTACATGAACTGGTATCAG CAGACCCCCGGCAAGGCCCCCAAGCGGTGGATCTACGACACCTCCAAGCTGGCCTCTGGCGTGCCCTCCAGATTCTCCCGGCTCTGGC TCTGGCACCGACTATACCTTCACCATCAGCTCCCTGCAGCCCGAGGATATCGCCACCTACTGCCAGCAGTGGTCCAGCAACCCC TTCACATTCGGCCAGGGCACCAAGCTGCAGATCACCTCTGGTGGCGGAGGCCAGGTGCAGCTGGTGCAGTCTGGCGCCCGAAGTGAAG AAACCTGGCGCCTCCGTGAAGGTGTCCTGCAAGGCTTCCGGCTACACCTTTACCAGCTACTGGATGCACTGGGTGCGACAGGCCCCT GGACAGGGCCTGGAATGGATGGGCAACATCTACCCAGGCTCCGGCGGCACCAACTACGCCGAGAAGTTCAAGAATAGAGTGACCATG ACCCGGGACACCAGCATCAGCACCGCTTACATGGAACTGTCCCGGCTGCGGAGCGACCACCGCCGTGTACTACTGCGCTAGATCC GGCGGACCCTACTTCTTCGACTACTGGGGCCCAGGGAACCCTCGTGACCGTGTCTAGTGGCGGCGGAGGATCAGGCGGAGGCGGATCT TCCATCTCCTGCCGGTCCTCTCAGAACATCGTGCACAACAACGGCATCACCTATCTGGAATGGTATCTGCAGAAGCCCGGCCAGTCC CCTCAGCTGCTGATCTACAAGGTGTCCGACCGGTTCTCCGGCGTGCCCGATAGATTTTCTGGCTCCGGCAGCGGCACCGATTTCACC CTGAAGATCTCCCGGGTGGAAGCCGAGGACGTGGGCGTGTACTATTGCTTTCAAGGCAGCCACATCCCCCCCACCTTGGGCAGGGC ACAAAGGTGGAAATCAAGTCCGGGGGGTGGCGGCCAAGTGACCCTGAAAGAGTCTGGCCCTGGCATCCTGCAGCCTTCCCAGACCCTG TCTCTGACCTGCTCCTTCAGCGGCTTCTCCCTGCGGACCTCTGGCATGGGAGTGGGCTGGATCAGACAGCCTTCTGGCAAAGGACTG GAATGGCTGGCCCACATTTGGTGGGACGACGACGACGAGCGGTACAACCCCGCCCTGAAGTCTCGGCTGACAATCTCCCAAGGACACCTCT GGGGGAGGCTCTGACATTGTGCTGACACAGTCTCCCGCCTCCCTGGCCGTGTCTCTGGGACAGAGAGCCACCATCTCTTGCAAGGCC TCCCAGTCCGTGGACTTCGACGGCGACTCCTTTATGAATTGGTATCAGCAGAAGCCTGGACAGCCTCCCAAACTGCTGATCTATACC ACCTCCAACCTGGAATCCCGGCATCCCTGCCCGGTTTTCCGCTTCCGGATCTGGCACAGACTTCACACTGAACATCCACCCCGTGGAA GAAGAGGACACCGCCACATATTATTGTCAGCAGAGCAACGAGGACCCCTACACCTTCGGCGGAGGCACTAAGCTGGAACTGAAGAG GGGGGAGGTGGACAGGTGCAGCTGGTGCAGAGCGGAGCTGAAGTGAAAAAGCCCAGGGGCCAGCGTGAAAGTGTCTTGTAAAGCCAGC AGCGGGGGGCACCAATTATGCTGAAAAGTTTAAAAACCGCGTGACAATGACCAGGGATACCTCTATCTCTACCGCCTATATGGAACTG AGCAGGCTGAGATCCGACGATACAGCTGTGTATTATTGCGCCCAGAAGCGGAGGCCCATATTTTTTTGATTACTGGGGGGCAGGGTACT AATGGGATTACTTACCTGGAATGGTATCTGCAGAAACCTGGACAGAGTCCACAGCTGCTGATCTACAAAGTGTCTGACAGATTCAGC GGAGTGCCTGACCGGTTTAGCGGCTCCGGCTCCGGAACAGACTTACTCTGAAGATTAGCCGCGTGGAAGCTGAGGATGTGGGAGTG TACTACTGTTTCCAGGGGTCTCATATTCCTCCCACTTTCGGACAGGGAACTAAGGTGGAAATCAAAAGCGGCGGAGGGGGCCAGGTG CAGCTGGTGCAGAGTGGTGGCGGAGTGGTGCAGCCTGGCAGATCCCCTGAGACTGAGCTGCAAGGCCAGCGGATATACCTTTACCCGG TACACCATGCACTGGGTGCGCCAGGCACCCGGAAAAGGACTGGAATGGATCGGCTACATCAACCCCTCCCGGGGCTACACCAATTAC AACCAGAAAGTGAAGGACCGGTTCACCATTTCCCGGGACAACTCCAAGAATACCGCCTTCCTGCAGATGGACTCCCTGCGGCCTGAA GATACCGGCGTGTACTTCTGTGCCCGGTACTACGACGACCACTACAGCCTGGATTATTGGGGCCAGGGTACACCAGTGACCGTGTCC TCCGCGGCTCTGGAAGTGCTGTTCCAGGGCCCCGACAAGACCTACACCTGTCCCCCTTGCCCCGCTCCTGAACTGCTGGGAGGCCCT AGCGTGTTCCTGTTCCCCCCAAAGCCCCAAGGACACCCTGATGATCAGCAGAACCCCCCGAAGTGACCTGCGTGGTGGTGGACGTGTCC CACGAGGACCCTGAAGTGAAGTTCAATTGGTACGTGGACGGCGTGGAAGTGCACAACGCCAAGACCCAGGCCAAGAGAGGAACAGTAC AACAGCACCTACAGAGTGGTGTCCGTGCTGACCGTGCTGCACCAGGATTGGCTGAACGGCAAAGAGTACAAGTGCAAGGTGTCCAAC AAGGCCCTGCCCGCCCATCGAAAAGACCATCAGCAAGGCCAAGGGCCAGGCCAGGGAACCCCCAGGTGTACACACTGCCTCCAAGC AGGGACGAGCTGACCAAGAACCAGGTGTCCCTGACCTGTCTCGTGAAGGGCTTCTACCCCTCCGATATCGCCGTGGAATGGGAGAGC AACGGCCAGCCCGAGAACAACTACAAGACCACCCCCCCCTGTGCTGGACAGCGACGGCTCATTCTTCCTGTACAGCAAGCTGACAGTG GACAAGAGCAGATGGCAGCAGGGCAACGTGTTCAGCTGCAGCGTGATGCACGAGGCCCTGCACAACCACCACCACCAGAAGTCCCTG AGCCTGAGCCCCGGCAAGTGACTCGAG

**Red shadow**, restriction enzyme site; black & <u>underline</u>, signal peptide (human β-lactalbumin); light green, hOL; blue, h5H; sky blue, h5L; orange, 3GH; yellow, 3GL; green, hOH; pink shadow, HRV3C protease recognition site; purple shadow, hinge region; gray shadow, human IgG1 Fc; <u>underline</u> in hinge, mutation H237Y

Figure S2. Gene sequence of TaKE2-Fc. Notably, four variable fragments from four different antibody clones were connected to form a circularly tetramerized structure and fused to a human Fc region. TaKE-Fc, Fc-fused T cell and natural killer cell engager; red shadow, restriction enzyme site; black & underline, signal peptide (human  $\beta$ -lactalbumin); light green, hOL; red, 2H; pink, 2L; orange, 3GH; yellow, 3GL; blue, h5H; sky blue, h5L; green, hOH; pink shadow; HRV3C protease recognition site; purple shadow, hinge region; gray shadow, human IgG1 Fc; underline in hinge, mutation H237Y.

## Gene sequence of TaKE2-Fc

GAATTCGCCACCATGAAATGGGTCACCTTTATCTCCCTGCTGTTCCTGTTCTCCTCCGCCTACTCCGACATCCAGATGACCCAGTCC CCCTCCAGCCTGTCTGCCTCTGTGGGGCGACAGAGTGACAATTACCTGCTCCGCCTCCTCCGCGTGTCCTACATGAACTGGTATCAG CAGACCCCCGGCAAGGCCCCCAAGCGGTGGATCTACGACACCTCCAAGCTGGCCTCTGGCGTGCCCTCCAGATTCTCCCGGCTCTGGC TCTGGCACCGACTATACCTTCACCATCAGCTCCCTGCAGCCCGAGGATATCGCCACCTACTACTGCCAGCAGTGGTCCAGCAACCCC TTCACATTCGGCCAGGGCACCAAGCTGCAGATCACCTCTGGTGGCGGAGGCCAGGTGCAGCTGAAGCAGTCTGGACCTGGACCTGGTG CAGCCCTCCCAGTCCCTGTCCATCACCTGTACCGTGTCCGGCTTCTCCCTGACCAACTACGGCGTGCACTGGGTGCGACAGTCTCCA GGCAAGGGCCTGGAATGGCTGGGAGTGATTTGGAGCGGCGGCAACACCGACTACAACACCCCTTTCACCTCCCGGCTGAGCATCAAC AAGGACAACTCCAAGTCCCAGGTGTTCTTCAAGATGAACAGCCTGCAGTCCAACGACACCGCCATCTACTATTGCGCCCAGAGCCCTG ACCTACTATGACTACGAGTTCGCCTACTGGGGCCAGGGAACCCTCGTGACAGTGTCTAGTGGCGGCGGAGGATCAGGCGGAGGCGGA GTGTCCTTCTCTTGTCGGGCCTCTCAGTCCATCGGCACCAACATCCATTGGTATCAGCAGCGGACCAACGGCTCCCCTCGGCTGCTG ATTAAGTACGCCTCCGAGTCTATCTCCGGCATCCCCTCCAGGTTTAGCGGCAGCGGCTCCGGCACAGACTTCACCCTGTCTATCAAC TCCGTGGAATCCGAGGACATTGCCGATTACTATTGTCAGCAGAATAATAACTGGCCAACCACGTTCGGCGCTGGCACAAAGCTGGAA CTGAAGTCCGGGGGTGGCGGCCAAGTGACCCTGAAAGAATCTGGCCCTGGCATCCTGCAGCCTAGCCAGACCCTGTCCCTGACCTGC CACATTTGGTGGGACGACGACGACGACGGTACAACCCCGCCCTGAAGTCTCGGCTGACAATCTCCAAGGACACCAGCAGCAATCAGGTG TTCCTGAAGATCGCCTCCGTGGACACCGCCGACACCGCTACCTATTACTGCGCCCAGATCAACCCTGCTTGGTTTGCCTATTGGGGA GACTTCGACGGCGACTCCTTTATGAATTGGTATCAGCAGAAGCCCGGCCAGCCTCCTAAGCTGCTGATCTACACCACCAGCAACCTG GAAAGCGGCATCCCTGCCCGGTTTTCTGCTTCTGGCAGCGGCACCGATTTCACACTGAACATCCACCCCGTGGAAGAGGAAGATACA GCCACCTATTACTGTCAGCAGAGCAACGAGGACCCCTACACCTTCGGAGGCGGGACCAAACTGGAACTGAAAAGCGGCGGTGGCGGA CAGGTGCAGCTGCAGAGCGGAGCCGAAGTGAAAAAGCCAGGCGCCAGCGTGAAGGTGTCCTGCAAGGCTTCCGGCTACACCTTT ACCAGCTACTGGATGCATTGGGTGCGCCAGGCCCCTGGGCAGGGGCTGGAATGGGCAATATCTACCCTGGCTCCGGCGGCACC AATTACGCCGAGAAGTTCAAGAATCGCGTGACCATGACCCGGGACACCTCTATCAGCACCGCTTACATGGAACTGTCCCGGCTGCGG AGCGACGATACCGCCGTGTACTACTGCGCTAGAAGCGGAGGCCCATATTTTTTTGATTACTGGGGGCAGGGTACTCTCGTGACTGTG TCCTCTGGCGGGGGGGGGGGCTCAGGTGGCGGAGGTAGCGGAGGTGGTGGATCTGGCGGCGGCGCTCTGACATCGTGATGACACAGAGT CCTCTGAGCCTGCCCGTGACCCCTGGCGAACCTGCCTCTATCTCCCTGCCGGTCCTCCCAGAACATCGTGCACAACAACGGCATCACC TATCTGGAATGGTATCTGCAGAAACCTGGACAGAGCCCTCAGCTGCTGATCTATAAGGTGTCCGACCGGTTCTCCGGCGTGCCCGAT AGATTCTCTGGATCCGGCTCCGGAACTGACTTTACACTGAAGATCTCCCCGGGTGGAAGCTGAGGACGTGGGAGTGTACTACTGTTTC CAGGGGTCTCATATTCCTCCCACCTTTGGGCAGGGCACTAAGGTGGAAATCAAAAGCGGAGGCGGTGGCCAGGTGCAGCTGGTGCAG TCAGGTGGCGGAGTGGTGCAGCCTGGCAGATCCCTGAGACTGAGCTGCAAGGCCTCTGGATACACATTCACCCGGTACACCATGCAC TGGGTGCGCCAGGCTCCCGGAAAAAGGACTGGAATGGATCGGCTACATCAACCCCTCCCGGGGCTACACCAACTACAATCAGAAAGTG AAGGACCGGTTCACCATTTCCCGGGACAACAGCAAGAACACCGCCTTTCTGCAGATGGACTCCCTGAGGCCTGAGGATACAGGCGTG TACTTCTGTGCCCGGTACTACGACGACCACTACAGCCTGGACTATTGGGGGGCAGGGAACCCCTGTGACCGTGTCATCCGCGGCTCTG GAAGTGCTGTTCCAGGGCCCCGACAAGACCTACACCTGTCCCCCTTGCCCCGCTCCTGAACTGCTGGGAGGCCCTAGCGTGTTCCTG TTCCCCCCAAAGCCCAAGGACACCCTGATGATCAGCAGAACCCCCCGAAGTGACCTGCGTGGTGGTGGACGTGTCCCACGAGGACCCT GAAGTGAAGTTCAATTGGTACGTGGACGGCGTGGAAGTGCAACGCCAAGACCCAAGACCAAGAGAACAAGTACAACAGCACCTAC AGAGTGGTGTCCGTGCTGACCGTGCTGCACCAGGATTGGCTGAACGGCAAAGAGTACAAGTGCAAGGTGTCCAACAAGGCCCTGCCT GCCCCCATCGAAAAGACCATCAGCAAGGCCAAGGGCCAGCCCAGGGAACCCCCAGGTGTACACACTGCCTCCAAGCAGGGACGAGCTG ACCAAGAACCAGGTGTCCCTGACCTGTCTCGTGAAGGGCTTCTACCCCTCCGATATCGCCGTGGAATGGGAGAGCAACGGCCAGCCC GAGAACAACTACAAGACCACCCCCCCCTGTGCTGGACAGCGACGGCTCATTCTTCCTGTACAGCAAGCTGACAGTGGACAAGAGCAGA TGGCAGCAGGGCAACGTGTTCAGCTGCAGCGTGATGCACGAGGCCCTGCACAACCACCACCAGAAGTCCCCTGAGCCTGAGCCCC GGCAAGTGA<mark>CTCGAG</mark>

**Red shadow**, restriction enzyme site; black & <u>underline</u>, signal peptide (human β-lactalbumin); light green, hOL; red, 2H; pink, 2L; orange, 3GH; yellow, 3GL; blue, h5H; sky blue, h5L; green, hOH; pink shadow; HRV3C protease recognition site; purple shadow, hinge region; gray shadow, human IgG1 Fc; <u>underline</u> in hinge, mutation H237Y

Figure S3. Gene sequence of TaKE3-Fc. Notably, four single-chain variable fragments from four different antibody clones were connected tandemly and fused to a human Fc region. TaKE-Fc, Fc-fused T cell and natural killer cell engager; red shadow, restriction enzyme site; black & underline, signal peptide (human  $\beta$ -lactalbumin); sky blue, h5L; blue, h5H; green, hOH; light green, hOL; pink, 2L; red, 2H; orange, 3GH; yellow, 3GL; pink shadow; HRV3C protease recognition site; purple shadow, hinge region; gray shadow, human IgG1 Fc; underline in hinge, mutation H237Y.

## Gene sequence of TaKE3-Fc

GAATTCGCCACCATGAAATGGGTCACCTTTATCTCCCTGCTGTTCCTGTTCTCCTCCGCCTACTCCGACATCGTGATGACCCAGTCC CCCCTGTCCCTGCCTGTGACACCTGGCGAGCCTGCCTCCATCTCCTGCCGGTCCTCTCAGAACATCGTGCACAACAACGGCATCACC TACCTGGAATGGTATCTGCAGAAGCCCGGCCAGTCCCCCTCAGCTGCTGATCTACAAGGTGTCCCGACCGGTTCTCCCGGCGTGCCCGAC AGATTTTCCGGCTCTGGCTCTGGCACCGACTTCACCCTGAAGATCTCCCCGGGTGGAAGCCGAGGACGTGGGCGTGTACTACTGTTTC CAGGGGTCTCATATTCCTCCCACCTTCGGCCAGGGCACCAAGGTGGAAATCAAGAGAGCTGCTGGCGGCGGAGGATCTGGCGGAGGT GGTAGTGGCGGAGCGGATCTCAGGTGCAGCTGCAGTCTGGCGCCCGAAGTGAAGAAACCTGGCGCCTCCGTGAAGGTGTCCTGC TACCCTGGCTCCGGCGCACCAACTACGCCGAGAAGTTCAAGAACAGAGTGACCATGACCCGGGACACCTCCATCAGCACCGCCTAC ATGGAACTGTCCCGGCTGAGAAGCGACGACGACGCCGTGTACTATTGCGCCCAGAAGCGGAGGCCCATATTTTTTTGATTACTGGGGC CAGGGAACCCTCGTGACCGTGTCATCTGCTGGGGGTGGTGGTGCTGCCAGGTGCAGCGGAGGCGGAGGCGGAGTGGTGCAGCCT GGCAGATCCCTGAGACTGAGCTGCAAGGCTTCTGGATATACCTTCACCCGGTACACCATGCATTGGGTGCGCCCAGGCTCCAGGCAAA GGCCTGGAATGGATCGGCTATATCAACCCCTCCCGGGGCTACACCAATTACAACCAGAAAGTGAAGGACCGGTTCACCATCTCTCGG GACAACTCCAAGAACACCGCCTTTCTGCAGATGGACTCCCTGCGGCCTGAGGATACCGGGGTGTACTTCTGCGCCCCGGTACTACGAC GACCACTACAGCCTGGACTATTGGGGGACAGGGCACCCCTGTGACAGTGTCTAGTGCTGGGGGGAGGGGGATCAGGTGGTGGTGGAAGT GGTGGCGGTGGCAGCGACATCCAGATGACTCAGAGCCCCTCCAGCCTGTCCGCCTCTGTGGGCGATAGAGTGACAATTACCTGCAGC GCCTCCTCCGTGTCTTACATGAACTGGTATCAGCAGACCCCCGGCAAGGCCCCCAAGCGGTGGATCTACGACACCAGCAAGCTG GCCTCTGGCGTGCCCTCCAGATTCTCTGGAAGCGGCAGCGGCACCGATTATACTTTCACCATCAGCTCCCTGCAGCCCGAAGATATC GCCACCTACTACTGCCAGCAGTGGTCCAGCAACCCCTTCACATTCGGACAGGGAACAAAGCTGCAGATCACCCGGGCAGCAGGGGGC GGAGGCTCTGATATTCTGCTGACCCAGAGCCCTGTGATCCTGTCCGTGTCCCCTGGCGAGAGAGTGTCCTTCTTGTCGGGCCTCC CAGTCCATCGGCACCAATATCCATTGGTATCAGCAGCGGACCAACGGCTCCCCCCGACTGATTAAGTACGCCTCCGAGTCTATC TCCGGCATCCCCAGCAGGTTTAGCGGCTCCGGCTCCGGAACAGATTTCACACTGTCCATCAACTCCGTGGAAAGCGAGGATATCGCC GATTACTATTGTCAGCAGAATAATAACTGGCCAACCACGTTCGGCGCTGGCACAAAGCTGGAACTGAAGAGGGCAGCCGGTGGCGGG CTGTCCATCACCTGTACCGTGTCCCGGCTTCTCCCTGACCAATTACGGCGTGCACTGGGTGCGCCAGAGTCCCCGGAAAAGGACTGGAA TGGCTGGGAGTGATTTGGAGCGGCGGCAACACCGACTACAACACCCCCTTTCACCTCCCGGCTGTCTATCAACAACGACAACAGCAACA CCTGGCATCCTGCAGCCTAGCCAGACCCTGTCTCTGACCTGCTCCTTCAGCGGCTTCAGCCTGCGGACCTCTGGCATGGGAGTGGGC TATTGTGCCCAGATCAACCCTGCTTGGTTTGCCTATTGGGGGCAGGGAACTCTCGTGACAGTGTCCGCCGCAGGCGGTGGTGGATCA GGTGGCGGCGGTTCTGGTGGCGGGATCTGACATCGTGCTGACACAGAGTCCTGCCTCCCTGGCCGTGTCTCTGGGACAGAGAGCT ACCATCTCTTGCAAGGCCAGCCAGTCCGTGGACTTCGACGGCGACTCCTTCATGAATTGGTATCAGCAGAAGCCTGGCCAGCCTCCC AAACTGCTGATCTATACCACCAGCAACCTGGAAAGCGGCATCCCTGCCCGGTTCTCTGCCTCCGGAAGCGGAACCGACTTTACACTG AACATCCACCCCGTGGAAGAAGAAGAAGACACCGCCACATATTACTGTCAGCAGAGCAACGAGGACCCCTACACCTTCGGAGGCCGGGACC AAACTGGAACTGAAACGTGCCGCGGCTCTGGAAGTGCTGTTCCAGGGCCCCGACAAGACCTACACCTGTCCCCCGTTGCCCCGCTCCT GAACTGCTGGGAGGCCCTAGCGTGTTCCTGTTCCCCCCAAAGCCCCAAGGACACCCTGATGATCAGCAGAACCCCCGAAGTGACCTGC GTGGTGGTGGACGTGTCCCCACGAGGACCCTGAAGTGAAGTTCAATTGGTACGTGGACGGCGTGGAAGTGCACAACGCCAAGACCAAG CCCAGAGAGGAACAGTACAACAGCACCTACAGAGTGGTGGTCGCGGCGGCGCGCACCAGGATTGGCTGAACGGCAAAGAGTAC AAGTGCAAGGTGTCCAACAAGGCCCTGCCTGCCCCCATCGAAAAGACCATCAGCAAGGCCAAGGGCCAGGCCAGGGAACCCCAGGTG TACACACTGCCTCCAAGCAGGGACGAGCTGACCAAGAACCAGGTGTCCCTGACCTGTCTCGTGAAGGGCTTCTACCCCTCCGATATC GCCGTGGAATGGGAGAGCAACGGCCAGCCCGAGAACAACTACAAGACCACCCCCCCTGTGCTGGACAGCGACGGCTCATTCTTCCTG TACAGCAAGCTGACAGTGGACAAGAGCAGATGGCAGCAGGGCAACGTGTTCAGCTGCAGCGTGATGCACGAGGCCCTGCACAACCAC TACACCCAGAAGTCCCTGAGCCTGAGCCCCGGCAAGTGACTCGAG

**Red shadow**, restriction enzyme site; black & <u>underline</u>, signal peptide (human β-lactalbumin); sky blue, h5L; blue, h5H; green, hOH; light green, hOL; pink, 2L; red, 2H; orange, 3GH; yellow, 3GL; pink shadow; HRV3C protease recognition site; purple shadow, hinge region; gray shadow, human IgG1 Fc; <u>underline</u> in hinge, mutation H237Y