CLAIMS

We claim:

1. A chimeric cytokine complex, comprising:
    a protein cage polypeptide, wherein the protein cage polypeptide comprises polypeptides that self-assemble into a tetrahedral pyramid structure;
    a plurality of engineered Fc antibody domains non-covalently bound to the protein cage polypeptide; and
    one or more cytokines covalently linked to each of the plurality of engineered Fc antibody domains.
2. The chimeric cytokine complex of claim 1, wherein the cytokines are interleukins.
3. The chimeric cytokine complex of claim 2, wherein the interleukins are at least one of interleukin-2s (IL-2s), IL-7s, and IL-15s.
4. A chimeric cytokine complex, comprising:
    a protein cage polypeptide;
    a plurality of engineered Fc antibody domains non-covalently bound to the protein cage polypeptide, wherein the plurality of engineered Fc antibody domains comprises between six and twelve engineered Fc antibody domains non-covalently bound to the protein cage polypeptide; and
    one or more cytokines covalently linked to each of the plurality of engineered Fc antibody domains.
5. The chimeric cytokine complex of claim 4, wherein between 12 and 24 cytokines are covalently linked to the plurality of engineered Fc antibody domains in total.
6. A chimeric cytokine complex, comprising:
    a protein cage polypeptide;
    a plurality of engineered Fc antibody domains non-covalently bound to the protein cage polypeptide; and
    one or more cytokines covalently linked to each of the plurality of engineered Fc antibody domains, wherein each of the one or more cytokines is covalently linked to one of the engineered Fc antibody domains via an engineered metalloprotease-resistant linker sequence.
7. The chimeric cytokine complex of claim 6, wherein the engineered metalloprotease-resistant linker sequence is between 7 to 13 amino acid residues in length.

8. The chimeric cytokine complex of claim 1, wherein at least one of the engineered Fc antibody domains is C-terminally covalently linked to an N-terminus of at least one of the cytokines.
9. The chimeric cytokine complex of claim 8, wherein one of the cytokines is interleukin-2 (IL-2), wherein at least one of the engineered Fc antibody domains is covalently linked to the IL-2 via an engineered metalloprotease-resistant linker sequence comprising the amino acid sequence SLSPGKAPTS (SEQ ID NO:20).
10. The chimeric cytokine complex of claim 8, wherein one of the cytokines is interleukin-7 (IL-7), wherein at least one of the engineered Fc antibody domains is covalently linked to the IL-7 via an engineered metalloprotease-resistant linker sequence comprising the amino acid sequence SLSPGKDCDIEGK (SEQ ID NO:21).
11. The chimeric cytokine complex of claim 8, wherein one of the cytokines is interleukin-15 (IL-15), wherein at least one of the engineered Fc antibody domains is covalently linked to the IL-15 via an engineered metalloprotease-resistant linker sequence comprising the amino acid sequence SLSPGKN (SEQ ID NO:22).
12. The chimeric cytokine complex of claim 1, wherein at least one of the engineered Fc antibody domains is N-terminally covalently linked to a C-terminus of at least one of the cytokines.
13. The chimeric cytokine complex of claim 12, wherein one of the cytokines is interleukin-2 (IL-2), wherein at least one of the engineered Fc antibody domains is covalently linked to the IL-2 via an engineered metalloprotease-resistant linker sequence comprising the amino acid sequence TPKSCDKTHT (SEQ ID NO:23).
14. The chimeric cytokine complex of claim 12, wherein one of the cytokines is interleukin-7 (IL-7), wherein at least one of the engineered Fc antibody domains is covalently linked to the IL-7 via an engineered metalloprotease-resistant linker sequence comprising the amino acid sequence HPKSCDKTHT (SEQ ID NO:24).
15. The chimeric cytokine complex of claim 12, wherein one of the cytokines is interleukin-15 (IL-15), wherein at least one of the engineered Fc antibody domains is covalently linked to the IL-15 via an engineered metalloprotease-resistant linker sequence comprising the amino acid sequence TSPKSCDKTHT (SEQ ID NO:25).
16. The chimeric cytokine complex of claim 1, wherein the engineered Fc antibody domains are engineered human Fc antibody domains.
17. The chimeric cytokine complex of claim 16, wherein the engineered human Fc antibody domains are engineered human IgG1 Fc antibody domains.