Claims

[Claim 1]

A multifunctional multispecific multimeric biomolecule polymer, comprising a polyubiquitin scaffold which is formed by covalently bonding two or more ubiquitins, and 2 to 10 biomolecules comprising binding moieties, each specific for different binding sites, wherein the biomolecule comprises active sites that specifically bind to other biomolecules, small molecule chemical compounds or nanoparticles, and is directly bound to the N-terminus, the C-terminus, or both the N-terminus and the C-terminus of the ubiquitin or is bound by a linker, and a carrier that prolongs the in vivo stability and duration of the biomolecule is directly bound to the N-terminus, the C-terminus, or both the N-terminus and the C-terminus of the ubiquitin or is bound by a linker, and

wherein the polyubiquitin scaffold is formed by covalently bonding a donor ubiquitin in which one or more lysines of the ubiquitin are substituted with other amino acids including arginine or alanine, and an acceptor ubiquitin in which lysine at the 6th, 11th, 27th, 29th, 33rd, 48th, or 63rd position from the N-terminus is substituted with other amino acids including arginine or alanine.

[Claim 2]

The multifunctional multispecific multimeric biomolecule polymer according to claim 1, wherein the linker is a combination of 1 to 30 repeats of GGGGS or EAAAK.

[Claim 3]

The multifunctional multispecific multimeric biomolecule polymer according to claim 1 or 2, wherein the biomolecule bound to the N-terminus of the ubiquitin is the distal end of the multimeric biomolecule polymer.

[Claim 4]

The multifunctional multispecific multimeric biomolecule polymer according to claim 1 or 2, wherein the biomolecule bound to the C-terminus, the N-terminus, or both the C-terminus and the N-terminus of the ubiquitin is the proximal end of the multimeric biomolecule polymer.

[Claim 5]

The multifunctional multispecific multimeric biomolecule polymer according to claim 1 or 2, wherein the carrier is one or more selected from the group consisting of albumin, antibody fragment, Fc domain, transferrin, XTEN (genetic fusion of non-exact repeat peptide sequence), CTP (carboxy-terminal peptide), PAS (proline-alanine-serine polymer), ELP

(elastin-like peptide), HAP (homo-amino acid polymer), GLK (gelatin-like protein), PEG (polyethylene glycol), and fatty acid.

[Claim 6]

The multifunctional multispecific multimeric biomolecule polymer according to claim 1 or 2, wherein leucine at the 73rd position from the N-terminus of the ubiquitin is substituted with other amino acids including proline.

[Claim 7]

The multifunctional multispecific multimeric biomolecule polymer according to claim 1 or 2, wherein the biomolecule is selected from the group consisting of insulin, insulin analogue, glucagon, glucagon-like peptides, GLP-1 and glucagon dual agonist, GLP-1 and GIP dual agonist, GLP-1 and glucagon and GIP triple agonist, exendin-4, exendin-4 analogue, insulin secreting peptide and an analogue thereof, human growth hormone, growth hormone releasing hormone (GHRH), growth hormone releasing peptide, granulocyte colony stimulating factor (G-CSF), anti-obesity peptide, G-protein-coupled receptor, leptin, GIP (gastric inhibitory polypeptide), interleukins, interleukin receptors, interleukin binding proteins, interferons, interferon receptors, cytokine binding proteins, macrophage activator, macrophage peptide, B cell factor, T cell factor, suppressive factor of allergy, cell necrosis glycoprotein, immunotoxin, lymphotoxin, tumor necrosis factor (TNF), tumor inhibitory factor, metastasis growth factor, alpha-1 antitrypsin, albumin, α-lactalbumin, apolipoprotein-E, erythropoietin (EPO), high glycosylated erythropoietin, angiopoietins, hemoglobin, thrombin, thrombin receptor activating peptide, thrombomodulin, blood factors VII, VIIa, VIII, IX, and XIII, plasminogen activator, fibrin-binding peptide, urokinase, streptokinase, hirudin, protein C, C-reactive protein, renin inhibitor, collagenase inhibitor, superoxide dismutase, platelet derived growth factor, epithelial growth factor, epidermal growth factor, angiostatin, angiotensin, bone morphogenetic growth factor, bone morphogenetic protein, calcitonin, atriopeptin, cartilage inducing factor, elcatonin, connective tissue activator, tissue factor pathway inhibitor, follicle stimulating hormone (FSH), luteinizing hormone (LH), luteinizing hormone releasing hormone (LHRH), nerve growth factors, parathyroid hormone (PTH), relaxin, secretin, somatomedin, adrenal cortical hormone, cholecystokinin, pancreatic polypeptide, gastrin releasing peptide, corticotropin releasing factor, thyroid stimulating hormone (TSH), autotaxin, lactoferrin, myostatin, receptor, receptor antagonist, fibroblast growth factor, adiponectin, interleukin receptor antagonist, cell surface antigen, virus derived vaccine antigen, monoclonal antibody, polyclonal antibody and antibody fragments.