Protein and Signaling Targets

Healthspan and regenerative medicine applications

Lionheart Health investigates coordinated protein signaling across tissue repair, organ health and healthy aging. This guide organizes potential biological roles by health area. Roles described include investigational applications and do not establish clinical benefit from Lionheart stimulation.

Muscle Health

Protein or signaling target	Potential health role
Follistatin - FST	Counteracts activin/myostatin signaling; investigated for muscle growth and recovery.
IGF-1	Supports muscle-cell survival, growth and repair.
Klotho - KL	Investigated for muscle resilience and healthier aging.
S100/S100A family	Calcium signaling relevant to muscle function; effects depend on the specific member.
"LIM muscle" / LIM-domain proteins	Muscle structure and signaling; the disclosed terminology does not identify one specific protein.
GDF11	Tissue-remodeling research; muscle effects are context-dependent.
Growth hormone - GH/HGH	Growth and metabolic regulation; excess is not a longevity strategy.
FOXO3	Stress resistance, autophagy and stem-cell maintenance.
AMPK	Cellular energy sensing and metabolic adaptation; a protein complex.
mTOR	Coordinates growth and protein synthesis with nutrient availability; requires balanced regulation.
SYK	Investigated as an inhibition/modulation target in mitochondrial and muscle research.
15-PGDH - HPGD	Inhibition improved aged-muscle performance in animal research; direction matters.

Immunity Health

Protein or signaling target	Potential health role
IL-10	Limits excessive inflammatory immune responses.
IL-6	Coordinates immune and exercise responses; persistent elevation can be harmful.
IL-33	Tissue alarm and immune-repair signaling; can also promote inflammation.
TNF-α	Infection defense and inflammatory signaling; excessive activity damages tissue.
IL-1β	Initiates inflammatory responses; chronic excess is undesirable.
TGF-β / TGF-β1	Immune regulation and repair; excessive signaling can promote fibrosis.
CXCL5	Recruits immune cells; effects vary with tissue and disease.

Sexual Health

Protein or signaling target	Potential health role
eNOS - NOS3	Produces nitric oxide involved in blood-vessel relaxation and erectile physiology.
VEGF	Vascular growth and repair.
SDF-1 - CXCL12	Recruitment of repair cells.
PDGF	Tissue repair and vessel maturation.
IGF-1	Muscle and nerve-cell support.
HGF	Cell survival, repair and regenerative signaling.

Brain Health

Protein or signaling target	Potential health role
BDNF	Neuronal survival, learning, memory and synaptic plasticity.
GDF10	Axonal sprouting and recovery of damaged neural connections.
Menin - MEN1	Investigated for hypothalamic inflammation and cognitive aging.
Klotho	Neuronal resilience and healthy brain-aging research.
GDF11	Experimental vascular and neural repair.
Sonic Hedgehog - SHH	Neural development and regenerative signaling; requires controlled exposure.
Apelin - APLN	Investigated for vascular, metabolic and neuronal support.
NANOG	Stem-cell identity and regenerative potential; uncontrolled activation is undesirable.
OSER1	Oxidative-stress resistance and mitochondrial resilience.
HMGB1	Damage detection and repair signaling; extracellular effects depend on molecular state and timing.
PD-1 - PDCD1	Immune checkpoint regulating cell activity.
PD-L1 - CD274	Immune checkpoint ligand; investigated in astrocyte-microglia communication.
P2RY12	Microglial receptor associated with surveillance and responses to injury.
PIEZO1	Mechanical-force sensing in bone cells; proposed bone-to-brain research connection.
HSP70 family	Protein protection and stress responses.
IL-1R2	Decoy receptor that can restrain IL-1 signaling.
APOL11a	Animal-study factor named in the announcement; species identity needs clarification.
PF4 - CXCL4	Platelet-derived immune and repair signaling.

Joint Health

Protein or signaling target	Potential health role
BMP9 - GDF2	Osteogenic signaling and bone formation.
BMP2	Bone formation and differentiation.
BMP10	Developmental and vascular signaling; distinct from BMP9.
OPG - TNFRSF11B	Limits RANKL-driven bone resorption.
RANKL - TNFSF11	Activates bone-resorbing cells; balance with OPG matters.
Osteocalcin - BGLAP	Bone-derived protein with proposed systemic metabolic functions.
RUNX2	Regulates osteoblast differentiation.
Alkaline phosphatase	Supports mineralization; the relevant isoenzyme should be specified.
Wnt signaling	Bone/cartilage renewal; a pathway containing multiple proteins.
15-PGDH	Inhibition is being investigated for cartilage regeneration.

Accelerated Wound Healing

Protein or signaling target	Potential health role
SDF-1 / CXCL12	Recruits progenitor and repair cells.
CXCR4	Receptor mediating SDF-1-directed cell migration.
PDGF	Fibroblast activity, repair and tissue organization.
VEGF / VEGF-A	Formation of blood vessels supplying healing tissue.
HIF-1α	Coordinates cellular responses to low oxygen.
EGF	Epithelial growth and wound closure.
HGF	Cell migration, survival and repair.
HMGB1	Can coordinate acute repair; chronic inflammatory forms may impair recovery.
Laminin / polylaminin	Extracellular scaffolding and cell attachment; polylaminin is a preparation.

Breast Augmentation

Protein or signaling target	Potential health role
SDF-1 / CXCL12	Proposed recruitment of endogenous repair cells to breast tissue.
VEGF	Proposed vascular support for tissue growth.
PDGF	Broader regenerative-platform tissue remodeling.
IGF-1	Broader growth and survival signaling.

Vision Health

Protein or signaling target	Potential health role
Klotho	Cellular resilience and inflammation research.
IGF-1	Retinal and neural-cell survival signaling.
SDF-1 and PDGF	Repair-cell recruitment and tissue organization.
HGF and EGF	Epithelial and tissue repair.
eNOS	Vascular function.
VEGF, HIF-1α and CXCL5	Vascular/inflammatory regulation; excessive angiogenesis can worsen retinal disease.

Hearing Health

Protein or signaling target	Potential health role
Wnt signaling	Proposed activation of cochlear regenerative processes.
Klotho	Proposed cellular protection and healthy-aging support.

Liver Health

Protein or signaling target	Potential health role
HGF	Liver-cell growth and repair signaling.
Klotho	Investigated for inflammatory and fibrotic protection.
Sestrin-2 - SESN2	Stress resistance and macrophage metabolic fitness.
SIRT1	Autophagy, metabolism and inflammatory regulation.
SIRT3	Mitochondrial metabolism and macrophage function.
SIRT6	Investigated for regulation of inflammation and fibrosis.

Kidney Health

Protein or signaling target	Potential health role
Klotho	Kidney-linked mineral metabolism, vascular protection and anti-fibrotic research.
HGF	Experimental repair and anti-fibrotic signaling.
SDF-1 / CXCL12	Recruitment of repair cells.
VEGF and eNOS	Renal microvascular support; inappropriate signaling may be harmful.
FOXO3, AMPK and mTOR	Proposed regulation of cellular stress, energy and repair.

Heart and Cardiovascular Health

Protein or signaling target	Potential health role
TBX20	Experimental cardiomyocyte proliferation and cardiac identity.
PITX2 / PITX2c	Experimental cardiac repair and antioxidant responses.
MEIS1	Proposed reduction to release cardiomyocyte cell-cycle arrest.
NPPA / pro-ANP / ANP	Natriuretic signaling, cardiovascular regulation and experimental repair.
VEGF	Vascular growth in ischemic tissue.
Klotho	Cellular protection and vascular-aging research.
Tropoelastin / elastin	Elastic-tissue structure; precursor and mature material should be distinguished.

Pancreas Health and Diabetes

Protein or signaling target	Potential health role
Neurogenin-3 - NEUROG3	Endocrine pancreatic-cell differentiation.
Activin A	Developmental and differentiation signaling.
Activin B	Related signaling with distinct biological effects.
IGF-1	Cell survival and metabolic regulation.
HGF	Pancreatic-cell growth and repair research.
Klotho	Investigated for metabolic and cellular protection.
FABP4	Lipid handling and metabolic inflammation; reduction is a proposed target.

Thymus Health

Protein or signaling target	Potential health role
Thymulin	Thymic peptide involved in immune and T-cell regulation.
Klotho	Proposed complementary support for immune aging.

Inflammation Reduction

Protein or signaling target	Potential health role
IL-10	Anti-inflammatory immune regulation.
TNF-α, IL-1β and IL-6	Targets for controlling excessive inflammatory signaling.
CXCL5	Context-dependent immune recruitment and inflammatory control.
TGF-β	Repair/immune balance; excessive activity can cause fibrosis.
HMGB1	Tune acute repair signaling while limiting chronic inflammatory effects.
Sestrins, including SESN2	Stress adaptation and metabolic regulation.
SIRT1, SIRT3 and SIRT6	Experimental inflammatory and mitochondrial regulation.
15-PGDH	Prostaglandin degradation; enhancement and inhibition have different consequences.

Blood Pressure Modulation

Protein or signaling target	Potential health role
eNOS	Nitric-oxide-mediated vessel relaxation.
ANP / NPPA-derived peptide	Salt excretion and cardiovascular pressure regulation.
Relaxin	Vascular relaxation and extracellular-matrix remodeling.
Tropoelastin	Arterial elastic structure.
SDF-1, VEGF, PDGF, HGF and IGF-1	Broader vascular repair targets; not interchangeable blood-pressure treatments.

Cancer Prevention and Treatment

Protein or signaling target	Potential health role
OPG / RANKL axis	Bone-tumor interactions and proposed cancer-treatment signaling.
Klotho	Experimental tumor-suppressive mechanisms in some cancer models.
CXCL5	Tumor-immune interactions; effects depend on cancer type.
PD-1 / PD-L1	Immune checkpoints; cancer applications differ from brain-aging concepts.
15-PGDH	Tumor-suppressive activity in some tissues; inhibition is not universally desirable.
HMGB1	Tumor, immune and damage signaling; may support or oppose cancer depending on context.

Addiction Recovery

Protein or signaling target	Potential health role
BDNF	Neural plasticity; addiction effects depend on brain region and timing.
GDF10 and Klotho	Proposed neural repair/resilience components of broader brain programs.
Menin, sirtuins and sestrins	Broader brain-health research; specific addiction efficacy remains unverified.

Lung Health

Protein or signaling target	Potential health role
Klotho	Proposed inflammatory and cellular protection.
CXCL5	Lung immune-cell recruitment; excessive signaling can drive injury.
HGF	Epithelial repair and anti-fibrotic research.
VEGF and HIF-1α	Vascular and oxygen-response signaling.
IL-10	Limiting excessive inflammation.

Pineal Gland Health

Protein or signaling target	Potential health role
Pineal-specific protein program	A pineal-specific protein target program has not been established in the cited public portfolio.
Klotho / longevity pathways	Broad brain-aging mentions do not establish a pineal application.
Melatonin	A tryptophan-derived hormone involved in sleep and circadian regulation; melatonin is not a protein.

Skin Health

Protein or signaling target	Potential health role
COL17A1 / collagen XVII	Epithelial attachment and stem-cell niche integrity.
Collagen I	Structural strength.
Collagen III	Repair-associated extracellular matrix.
Tropoelastin / elastin	Elasticity.
SDF-1 and PDGF	Repair-cell recruitment and remodeling.
EGF and IGF-1	Growth and survival signaling.
Klotho	Investigated for aging-associated inflammatory protection.
Laminin	Basement-membrane structure and cell attachment.

Hair Scalp Wellness

Protein or signaling target	Potential health role
SCF / KITLG; c-KIT / KIT	Melanocyte survival.
WNT3A; WNT10B; β-catenin	Stem-cell activation.
MITF	Pigment-cell identity.
TYR / tyrosinase	Melanin synthesis.
TYRP1; DCT / TYRP2	Pigment processing.
α-MSH; POMC; MC1R	Melanocortin signaling.
EDN1; EDNRB	Melanocyte activation.
FGF2; FGF7 / KGF	Follicular support.
PDGF-AA; PDGF-BB	Tissue remodeling.
NGF; GDNF; BDNF	Neurotrophic signaling.
NRF2 / NFE2L2	Antioxidant regulation.
Catalase	Peroxide breakdown.
SOD1; SOD2	Antioxidant defense.
GPX1	Peroxide detoxification.
BCL-2; survivin / BIRC5	Cell survival.
PGC-1α / PPARGC1A	Mitochondrial regulation.
Noggin - NOG	BMP antagonism.
IL-17 signaling	Inflammation reduction target.

Hair peptide formulation components

Protein or signaling target	Potential health role
Copper Tripeptide-1 - GHK-Cu	Named stack component.
Acetyl Tetrapeptide-3	Named stack component.
sh-Polypeptide-1	Named recombinant ingredient.
sh-Oligopeptide-2	Named recombinant ingredient.
sh-Polypeptide-9	Named recombinant ingredient.
sh-Oligopeptide-10	Named recombinant ingredient.
sh-Polypeptide-11	Named recombinant ingredient.

Stem Cell Homing Proliferation and Differentiation Control

Protein or signaling target	Potential health role
SDF-1 / CXCL12	Stem-cell homing. Creates a recruitment signal that attracts responsive stem and progenitor cells toward damaged tissue.
PDGF	Homing, migration and proliferation. Supports recruitment and expansion of responsive repair cells, tissue remodeling and vessel maturation. Lionheart disclosures identify it as a second homing factor.
CXCR4	Homing receptor. Enables responsive cells to detect and follow SDF-1 signals.
HMGB1	Injury signaling and recruitment. May coordinate repair-cell migration and regeneration; effects depend on molecular form, timing and inflammatory conditions.
IGF-1	Survival and proliferation. Supports survival and growth of responsive cells during repair.
HGF	Migration, survival and growth. Supports tissue-dependent repair and regenerative responses.
EGF	Proliferation. Promotes growth of responsive epithelial cells and progenitors.
FGF / FGF2	Proliferation and niche support. Supports expansion of selected progenitor populations; effects depend on cell type.
Activin A / Activin B	Differentiation signaling. Helps regulate developmental programs and cell fate in specific biological contexts.
Neurogenin-3 - NEUROG3	Tissue-specific differentiation. Directs endocrine-cell development, particularly relevant to pancreatic research.
Wnt signaling	Activation and differentiation. Regulates stem-cell renewal and tissue-specific regenerative programs.
BMP2 / BMP9	Bone differentiation. Promotes osteogenic differentiation in appropriate cell populations.
Sonic Hedgehog - SHH	Developmental and progenitor signaling. Helps regulate progenitor activity and tissue patterning.
NANOG	Stem-cell identity. Maintains aspects of pluripotency; controlled differentiation requires appropriate changes in this program.
COL17A1 / collagen XVII	Stem-cell competition and niche attachment. Helps epidermal stem cells remain attached to their supporting basement membrane. Differences in COL17A1 influence competition between neighboring stem cells, favoring retention and expansion of fitter cells.