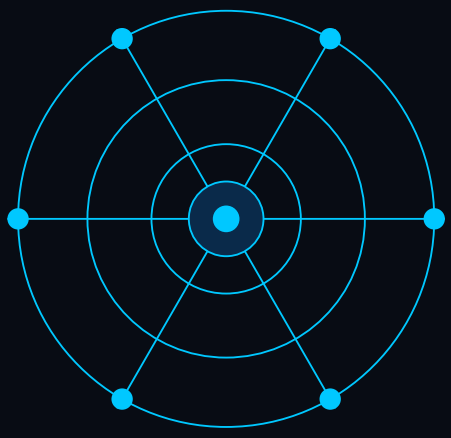
HUMAN CATHELICIDIN · 37-AMINO ACID ANTIMICROBIAL PEPTIDE

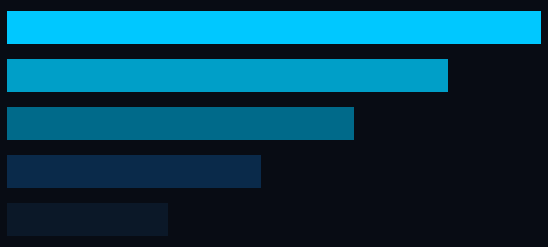
LL-37

Defend. Repair. Regulate.
Your Body's First Line of Defense.

ANTIMICROBIAL · IMMUNE MODULATION · WOUND HEALING · ANTI-INFLAMMATORY

LL-37 is the only known member of the human cathelicidin family — a multifunctional antimicrobial peptide naturally produced by immune cells, skin, and mucosal surfaces. Far more than a simple antibiotic, **LL-37** orchestrates complex immune responses, accelerates tissue repair, disrupts bacterial biofilms, and modulates inflammation across virtually every system in the body. It is one of the most studied innate immunity peptides in modern medicine.





37	Cathelicidin	Innate	Broad
AMINO ACIDS	PEPTIDE FAMILY	IMMUNE ORIGIN	SPECTRUM ACTION

What Is LL-37?

The only human cathelicidin — your body's built-in antimicrobial shield

Born From Immunity, Built for Battle

LL-37 is a 37-amino acid peptide cleaved from the precursor protein hCAP-18, encoded by the **CAMP gene** — the sole cathelicidin in the human genome. It is produced and secreted by neutrophils, macrophages, NK cells, mast cells, and epithelial cells lining the skin, lung, gut, and urogenital tract. Its name reflects its structure: two leucine (L) residues at its N-terminus and a 37-amino acid chain. Unlike conventional antibiotics, LL-37 does not rely on a single target — it disrupts bacterial membranes, neutralizes endotoxins, recruits immune cells, promotes tissue repair, and **modulates both pro- and anti-inflammatory pathways** simultaneously, making it uniquely suited for complex infectious and inflammatory environments.

How It Works — Membrane Disruption & Immune Orchestration

LL-37 kills pathogens through a fundamentally different mechanism than conventional antibiotics. Its amphipathic alpha-helical structure allows it to insert into and disrupt bacterial, fungal, and viral lipid membranes — causing irreversible membrane permeabilization. Critically, it is active against bacteria that have developed resistance to traditional antibiotics, and it effectively destroys **biofilms** — structured microbial communities that are notoriously resistant to standard treatments. Beyond direct killing, LL-37 binds lipopolysaccharide (LPS) to neutralize septic shock signals, stimulates keratinocyte migration for wound closure, promotes angiogenesis, and activates dendritic cells and T-cells to amplify adaptive immunity.

Four Core Mechanisms

1 — Membrane Disruption

Inserts into and destroys bacterial, fungal, and viral cell membranes directly.

2 — Biofilm Eradication

Penetrates and dismantles polymicrobial biofilms resistant to conventional antibiotics.

3 — Immune Modulation

Recruits neutrophils, activates dendritic cells, and calibrates pro/anti-inflammatory balance.

4 — Tissue Repair & Angiogenesis

Accelerates wound closure, stimulates new blood vessel formation and epithelialization.

★ RESISTANCE-PROOF: A DIFFERENT KIND OF ANTIBIOTIC

Because LL-37 kills by disrupting the physical architecture of microbial membranes — rather than targeting a specific enzyme or receptor — bacteria cannot easily evolve resistance to it. This makes LL-37 a compelling candidate in the era of antibiotic-resistant superbugs and chronic biofilm-associated infections.

The Benefits of LL-37

One peptide. Broad-spectrum defense. Infection, inflammation, repair, and beyond.

01 Broad-Spectrum Antimicrobial Activity

LL-37 directly kills Gram-positive and Gram-negative bacteria, fungi, enveloped viruses, and even some parasites — providing a comprehensive front-line defense that no single conventional antibiotic can match.

02 Biofilm Disruption

Chronic infections caused by biofilm-forming bacteria (Pseudomonas, Staphylococcus, Candida) are notoriously treatment-resistant. LL-37 penetrates and destroys these protective matrices, exposing pathogens to immune clearance.

03 Accelerated Wound Healing

LL-37 stimulates keratinocyte migration, proliferation, and differentiation — the cellular processes that close wounds. It also promotes angiogenesis and collagen remodeling, accelerating both superficial and deep tissue repair.

04 Immune Modulation & Inflammation Control

LL-37 uniquely calibrates the immune response — amplifying it when infection demands and dampening it when excessive inflammation threatens tissue damage. This dual role makes it relevant to both infectious and autoimmune conditions.

05 Endotoxin Neutralization & Sepsis Protection

By binding and neutralizing bacterial LPS (endotoxin), LL-37 blocks the cytokine storm that drives septic shock — one of the leading mechanisms of mortality in severe bacterial infections and critical illness.

06 Antiviral Defense

LL-37 disrupts the lipid envelopes of numerous viruses including influenza, HIV, RSV, and coronaviruses — offering broad antiviral activity via the same membrane-disruption mechanism it employs against bacteria.

07 Gut Health & Mucosal Immunity

Expressed throughout the gastrointestinal epithelium, LL-37 protects mucosal surfaces from pathogenic invasion, supports tight junction integrity, and modulates the gut microbiome — playing a key role in gut barrier function and IBD pathology.

08 Anti-Tumor & Cancer-Relevant Activity

Emerging research demonstrates LL-37's ability to induce apoptosis in certain cancer cell lines, inhibit tumor angiogenesis, and stimulate anti-tumor immune responses — positioning it as a candidate in immuno-oncology research.

LL-37 is not simply an antimicrobial — it is a master regulator of innate immunity, tissue defense, and repair. As antibiotic resistance accelerates globally, this endogenous peptide may represent one of medicine's most valuable untapped therapeutic assets.