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Mastoparans

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Potential competing interests: No potential competing interests to declare.

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The mastoparans, the most widely described class of peptides isolated from the venom of different wasp species, were named after their first recognized target, mast cells. They are lysine-rich peptides and perform several biological functions, including the release of mediators through activation of G-protein receptors, stimulation of phospholipase A2 and C, mobilization of Ca2+ to the sarcoplasmic reticulum, involvement in cell death by necrosis or apoptosis, and antimicrobial activity. Studies carried out with different types of mastoparans showed that some peptides have low hemolytic activity, but high antibiotic activity (Figure 1) [1-4].

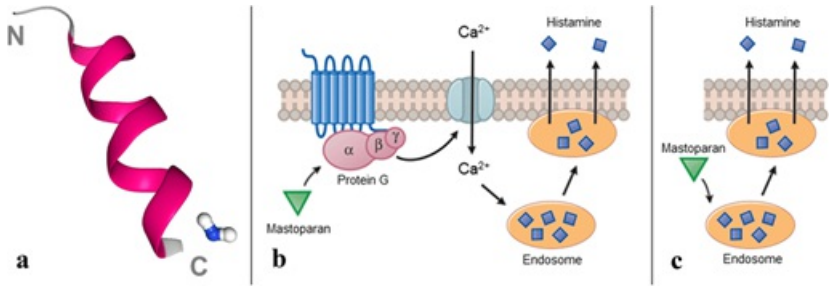

Figure 1. Biochemistry of mastoparan. a α-Helical secondary structure of mastoparan-X isolated from Vespa xanthoptera (NCBI-Protein). Histamine released by b G protein binding and c direct endosome binding.
Source: https://www.researchgate.net/figure/Biochemistry-of-mastoparan-a-a-Helical-secondary-structure-of-mastoparan-X-isolated-from_fig2_343165039.

Several studies have shown that mastoparans interact with natural and artificial biological membranes, assuming an amphipathic α-helix conformation, which may cause an increase in permeability, which is the primary cause of the effect of releasing mediators of cell activation. The need to understand the mechanism of action of peptides, such as mastoparanes, has opened up a vast field for research on the structures

[[´= and functions of these compounds. Many authors claim that the structure strongly interferes with the intensity and/or type of biological activity of biologically active peptides [4-7].

Therefore, their structures must be determined, not only to explain their biological activities but also to favor the

development of new drugs. The first mastoparan from the venom of the social wasp Vespa lewisii (Cameron, 1903). This peptide, composed basically of lysine and hydrophobic amino acid residues, was the first example of a mast cell degranulation peptide isolated from wasp venom. The Eumenine Mastoparano-AF of the solitary wasp *Anterhynchium flavomarginatum* (Smith, 1852) differs from other mastoparan os described by the distinct positioning of lysine. This peptide was considered the main peptide component of the venom of this wasp, with biological activities similar to those of classic mastoparans (Figure 2) [7-10].

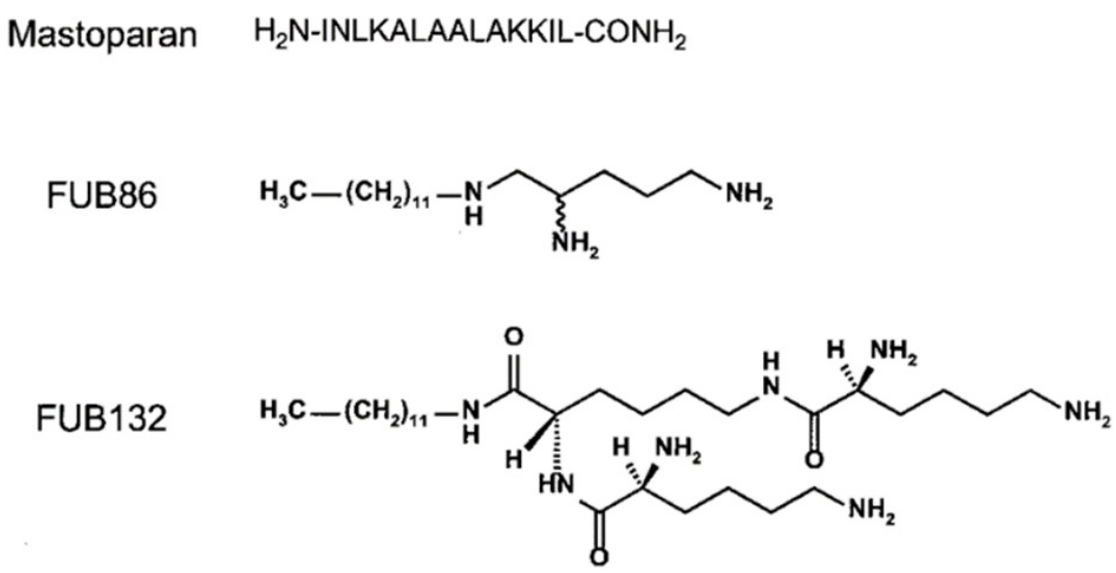

Figure 2. Structure of mastoparan, FUB86, and FUB132. The synthesis of FUB132 is outlined under Experimental Procedures. Source: https://www.researchgate.net/figure/Structure-of-mastoparan-FUB86-and-FUB132-The-synthesis-of-FUB132-is-outlined-under_fig1_11508000.

Figure 2. Main biological activities exhibited by mastoparans. Sources: DOI: 10.3389/fmolb.2022.824989 PMID: 35813822; PMCID: PMC9263278.

Structurally, wasp peptides are presented in an α-helix conformation, having 10 to 14 amino acid residues in their primary sequence. They are rich in hydrophobic amino acids such as leucine, isoleucine, and alanine, as well as some lysine in their primary sequences. Although the amino acid sequences of these peptides are relatively conserved, substitutions of some residues seem to alter the biological activities of these peptides, proving to be an interesting basis for future studies using pharmacological applications (Figure 3) [10-12].

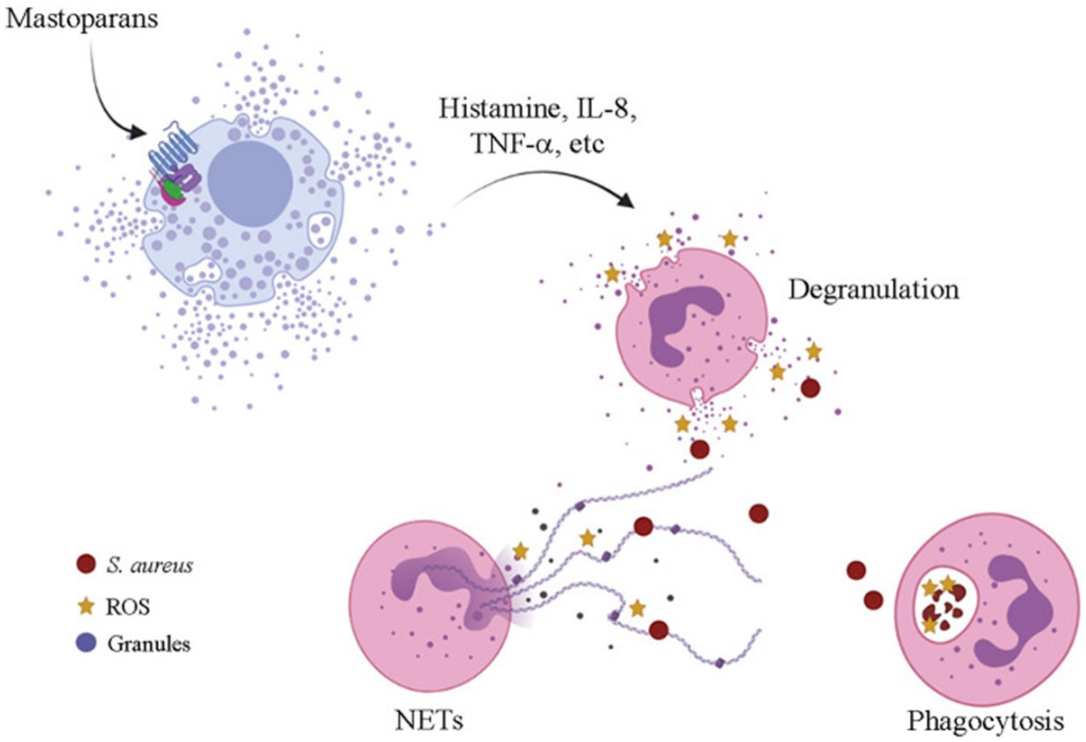

Figure 3. Mrgprb2-mediated mast cell activation by mastoparans leading to neutrophil recruitment and *Staphylococcus aureus* (Bacillales: Staphylococcaceae). clearance in a mouse dermonecrotic-infected lesion. ROS—reactive oxygen species; NETs—neutrophil extracellular traps. Sources: DOI: 10.3389/fmolb.2022.824989 PMID: 35813822; PMCID: PMC9263278.

Different amino acid sequences of the mastoparan peptide isolated from the social wasp species *Polybia paulista* Ihering, 1896 were identified. The polybia-MPI and polybia-CP peptides, synthesized from the venom of the wasp P. paulista, show potent antibacterial activity against strains of *Escherichia coli*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Bacillus subtilis*. Two other peptides with antibacterial activity, called Polybina I and II, were also isolated from the same species of wasp. The venom of *Polybia occidentalis* (Olivier, 1791), a social wasp, has anticoagulant and fibrinogenio-degrading pharmacological properties. Anticoagulation occurs at different stages of the coagulation process in the intrinsic, extrinsic, and specific pathways. The venom can inhibit platelet aggregation and destroy plasma fibrinogens [12-14].

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