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[Continued on next page]

(54) Title: ANTIBACTERIAL PEPTIDES, AND USES THEREOF

(57) Abstract: A natural antibacterial peptide comprising a antibacterial fragment of a protein selected from SEQUENCE ID NO's: 1 to 6, and a composition comprising a plurality of antibacterial peptides, is described. Also disclosed is the use of the peptides and compositions as an antibacterial agent, or as an active agent in the treatment or prevention of diseases or conditions caused by bacterial infection.

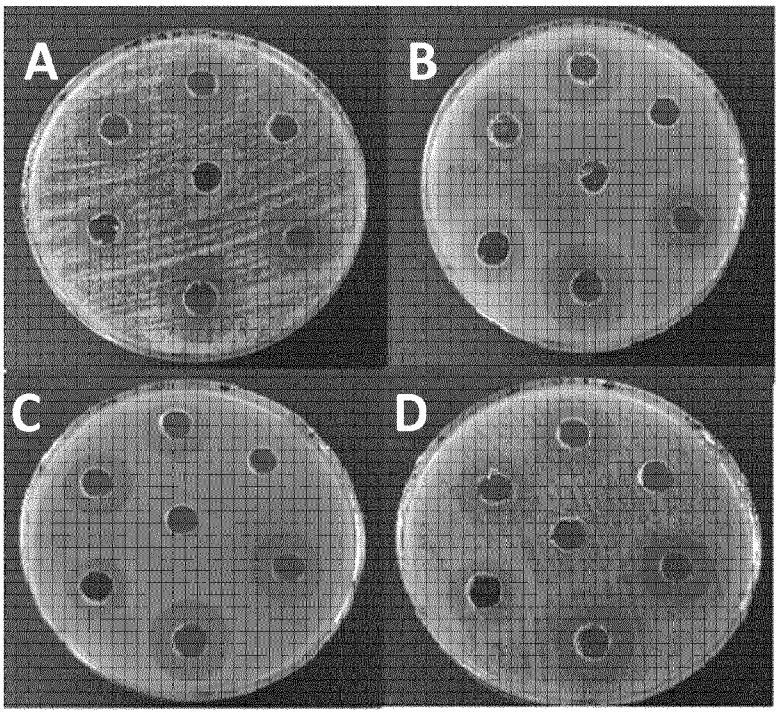

FIGURE 1

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Title

ANTIBACTERIAL PEPTIDES, AND USES THEREOF

Background to the Invention

Hundreds of millions of people are affected each year by serious bacterial infections (WHO, 2014). Many die from these infections due to antibiotic resistance (WHO, 2014). Antibiotics are not only used heavily in the treatment of human bacterial infections but are also used in the animal farming area to maintain the health of many animals. As antibiotic resistance increases globally, the use of antibiotics for both human and animal health is of major concern and will have major implications in the 21st century. Indeed, the WHO indicates in their 2014 report on antimicrobial resistance that "resistance to common bacteria has reached alarming levels in many parts of the world and in some settings, few, if any, of the available treatments options remain effective for common infections" (WHO, 2014).

Most of the current antibiotics on the market function within bacteria after penetrating the bacterial cell. The antibiotic performs its function through the inhibition of translation, the inhibition of DNA synthesis, or the inhibition of cell wall synthesis. Two examples of antibiotics used today include tetracycline, which inhibits translation within the bacterial cell by binding to ribosomes, and Penicillin, which inhibits cell wall synthesis.

However, most antibiotic mechanisms of action create bacterial resistance. The bacterium mutates and becomes resistant to an antibiotic by either changing its wall permeability, changing the receptor's 3-D structure, or, literally, destroying the antibiotic.

Besides the above, most of the current antibiotics have drastic side effects such as allergic reactions, nausea, diarrhoea, stomach pain, fever, headache and even kidney and liver damage. Therefore, there is a clear and growing need for the identification of new agents that have an anti-microbial activity with low side effects and that can ultimately cause little or no bacterial resistance.

Anti-microbial peptides (AMP) have a much broader action compared to other antibiotics. These peptides usually bind by electrostatic forces to, for example, charged lipids or amino acids on the membrane, causing perforation of the membrane. The inner part of the bacterial cell is thus exposed to external pressure and conditions and undergoes lyses. The perforation action of an anti-microbial peptide makes it very hard for the bacteria to build resistance as it is being destroyed from the outside rather than the inside.

On one hand our body already uses bioactive peptides to fight Gram-positive and Gram-negative bacteria, fungi, parasites and some viruses as a part of the body's innate immunity (Gordon Y.J. *et al.*, 2005). On the other hand, it has been shown that some foods such as milk contain some very interesting peptides with AM activity (Dallas D.C., *et al.*, 2013).

We set out to identify food derived anti-microbial peptides, which, because our bodies are already accustomed to processing food molecules, are safer and as effective as antibiotics. The peptides identified can be used in many different products such as personal care, supplements, pharmaceuticals and food preservatives. In personal care for instance, these peptides can be used as an anti-odour, in pharmaceuticals they can be used to treat infections, and in food, they can be used as preservatives. These peptides also have uses as biocides in hospital settings and in agriculture to protect plants.

It is an object of the invention to provide a natural, food grade, antibacterial agent.

Statements of Invention

The pea genome codes for over 70,000 different proteins. The Applicant has identified three of these proteins, each of which contains one or more peptides capable of inhibiting growth of bacteria (hereafter "antibacterial peptide" or "antibacterial fragment"). Likewise, out of the more than 60,000 proteins encoded by the rice genome, the Applicant has identified three proteins, each of which contains one or more peptides capable of inhibiting growth of bacteria. Antibacterial fragments of the six identified proteins, and compositions containing a plurality of the antibacterial peptides have been shown to inhibit bacterial growth in agar plates. The specific plant proteins from which the natural peptides are derived are provided herein, and include SEQUENCE ID NO: 1-6. The specific pea proteins from which the peptides are derived are provided herein and include SEQUENCE ID NO: 1-3, and the specific rice proteins from which the peptides are derived are provided herein and include SEQUENCE ID NO: 4-6. Homologs of these proteins are described in SEQUENCE ID NO: 36-53. The specific peptides initially identified in the pea proteins are shown in SEQUENCE ID NO's: 7-25, 66-73, 81 and 106-251. The specific peptides initially identified in the rice proteins are shown in SEQUENCE ID NO's: 26-35, 74-80, 82-98, and 99-105. Additional peptides from the pea or rice proteins are provided is SEQUENCE ID NO: 54 to 65.

In a first aspect, the invention provides a peptide, typically 5 to 50 amino acids in length, and comprising a fragment of a pea or rice protein, typically selected from SEQUENCE ID NO's: 1 to 6, or a homolog thereof, or a variant of the fragment (hereafter "peptide of the invention").

In one embodiment, the peptide is bioactive. In none embodiment, the peptide is anti-bacterial.

In one embodiment, the peptide of the invention comprises a sequence selected from SEQUENCE ID NO: 7 to 35 and 54 to 251.

In one embodiment, the peptides of the invention consists of sequence selected from SEQUENCE ID NO: 7 to 35 and 54 to 251.

In one embodiment, the fragment has between 8 and 13 amino acids. In one embodiment, the fragment has a charge of -1 and 0.

Preferably, the c-terminal amino acid is not C, F, I, K, M, P, Q, R, T, V, W

Preferably, the n-terminal amino acid is not C, D, H, K, M, P, Q, T, V, W

Preferably, the c-terminal domain of the fragment does not contain C, M, V or W.

Preferably, the n-terminal domain of the fragment does not contain K, M, R, T, W, C, F, I.

Preferably, the fragment or peptide does not contain C.

Preferably, the fragment or peptide does not contain M.

Preferably, the fragment or peptide does not contain W.

Preferably, the fragment is selected from SEQUENCE ID NO's: 7-35, or a variant of the fragment.

Preferably, the peptide comprises or consists of a fragment selected from SEQUENCE ID NO's: 7-35, or a variant of the fragment.

In one embodiment, the peptide comprises a fragment of SEQUENCE ID NO: 32, or a variant of the fragment.

In one embodiment, the peptide of the invention is modified. The term "peptide of the invention" includes modified peptides.

Also provided are conjugates comprising a peptide of the invention conjugated to a binding partner, optionally via a linker.

[SEQUENCE ID NO: 1 (Pea Protein 1 – P13918)]

Preferably, the peptide comprises a bioactive fragment of the protein of SEQUENCE ID NO: 1 or a homolog thereof, or a bioactive variant of the fragment.

Preferably, the peptide comprises a bioactive fragment selected from SEQUENCE ID NO'S: 7-9 or 81, or a bioactive variant of the fragment.

The invention also provides a composition comprising at least 1, preferably at least 2, preferably at least 3, preferably at least 4, preferably at least 5, preferably at least 6, preferably at least 7, preferably at least 8, preferably at least 9, or preferably at least 10 antibacterial peptides including a bioactive fragment of the protein of SEQUENCE ID NO: 1 or a homolog thereof, or a bioactive variant of the fragment. When the composition comprises a plurality of peptides, each comprises a different antibacterial fragment of SEQUENCE ID NO: 1 (for example the fragments of SEQ ID 7-9 or 81), or a homolog thereof. Preferably, the composition comprises a first antibacterial peptide comprising a first antibacterial fragment selected from SEQUENCE ID NO: 7-9 or 81 (or a bioactive variant of the fragment), and a second antibacterial peptide comprising a second antibacterial fragment selected from SEQUENCE ID NO: 7-9 or 81 (or a bioactive variant of the fragment). Preferably, the composition comprises substantially all of the fragments of SEQ ID 7-9 and 81, or peptides of the invention comprising all of the fragments of SEQ ID 7-9 and 81.

Homologs of Pea Protein 1 (SEQUENCE ID NO: 1) include Vicia fabia, Cicer arietinum and Lens culinaris homologs (SEQ ID NO: 53, 36 and 37).

[SEQUENCE ID NO: 2 (Pea Protein 2 – Q9M3X6)]

Preferably, the peptide comprises a bioactive fragment of the protein of SEQUENCE ID NO: 2, or a homolog thereof, or a bioactive variant of the fragment.

Preferably, the peptide comprises a bioactive fragment selected from SEQUENCE ID NO'S: 10-19 and 106-251, or a bioactive variant of the fragment.

The invention also provides a composition comprising at least 1, preferably at least 2, preferably at least 3, preferably at least 4, preferably at least 5, preferably at least 6, preferably at least 7, preferably at least 8, preferably at least 9, or preferably at least 10 antibacterial peptides of the invention including a bioactive fragment of the protein of SEQUENCE ID NO: 2 or a homolog thereof, or a bioactive variant of the fragment. When the composition comprises a plurality of peptides, each peptide comprises a different antibacterial fragment of SEQUENCE ID NO: 2 (for example the fragments of SEQ ID 10-19), or a homolog thereof. Preferably, the composition comprises a first antibacterial peptide comprising a bioactive fragment selected from SEQUENCE ID NO 10-19, and a second antibacterial peptide comprising a bioactive fragment selected from SEQUENCE ID NO 10-19. Preferably, the composition comprises substantially all of the fragments of SEQ ID 10-19 and 106-251, or variants thereof.

Homologs of Pea Protein 2 (SEQUENCE ID NO: 2) include Pisum abyssinicum, Lathyrus annuus, and Vicia villosa (SEQ ID 38-40).

[SEQUENCE ID NO: 3 (Pea Protein 3 – D3VNE2)]

Preferably, the peptide comprises a bioactive fragment of the protein of SEQUENCE ID NO: 3, or a homolog thereof, or a bioactive variant of the fragment.

Preferably, the peptide comprises a bioactive fragment selected from SEQUENCE ID NO 20-25 and 66-73, or an antibacterial variant of the fragment.

The invention also provides a composition comprising at least 1, preferably at least 2, preferably at least 3, preferably at least 4, preferably at least 5, preferably at least 6, preferably at least 7, preferably at least 8, preferably at least 9, or preferably at least 10 antibacterial peptides of the invention including a bioactive fragment of the protein of SEQUENCE ID NO: 3 or a homolog thereof, or a bioactive variant of the fragment.

Homologs of Pea Protein 3 (SEQUENCE ID NO: 3) include Lens culinaris, Vicia narbonensis, and Medicago truncatula (SEQ ID NO: 41-43).

[SEQUENCE ID NO: 4 (Rice Protein 1 – P14323)]

Preferably, the peptide comprises a bioactive fragment of the protein of SEQUENCE ID NO: 4, or a homolog thereof, or a bioactive variant of the fragment.

Preferably, the peptide comprises a bioactive fragment selected from SEQUENCE ID NO'S: 26-30 and 82-98, or a bioactive variant of the fragment.

The invention also provides a composition comprising at least one or more peptides of the invention including a bioactive fragment of SEQUENCE ID NO: 4 or a homolog thereof. Preferably, the composition comprises a first peptide comprising a antibacterial fragment SEQ ID NO: 26-30 and a second peptide comprising a antibacterial fragment SEQ ID NO: 26-30. Preferably, the composition comprises substantially all of the fragments of SEQ ID 26-30 and 82-98, or peptides of the invention comprising all of the fragments of SEQ ID 26-30.

Homologs of Rice Protein 1 (SEQUENCE ID NO: 4) include Oryza brachyantha, and Zizania latifolia (SEQ ID NO: 44-46).

[SEQUENCE ID NO: 5 (Rice Protein 2 – P14614)]

Preferably, the peptide comprises a bioactive fragment of the protein of SEQUENCE ID NO: 5, or a homolog thereof, or a bioactive variant of the fragment.

Preferably, the peptide comprises a bioactive fragment selected from SEQUENCE ID NO'S: 31 or 32 and 99-105, or a bioactive variant of the fragment.

The invention also provides a composition comprising at least 1, preferably at least 2, preferably at least 3, preferably at least 4, preferably at least 5, preferably at least 6, preferably at least 7, preferably at least 8, preferably at least 9, or preferably at least 10 antibacterial peptides of the invention, each of which comprises a bioactive fragment of SEQUENCE ID NO: 5 or a homolog thereof.

Homologs of Rice Protein 2 (SEQUENCE ID NO: 5) include Oryza sativa Japonica Group and Seed Storage Globulin (SEQ ID 47-49).

[SEQUENCE ID NO: 6 (Rice Protein 3 – P07728)]

Preferably, the peptide comprises a bioactive fragment of the protein of SEQUENCE ID NO: 6 or a homolog thereof, or a bioactive variant of the fragment.

Preferably, the peptide comprises a bioactive fragment selected from SEQUENCE ID NO'S: 33-35 and 74-80, or a bioactive variant of the fragment.

The invention also provides a composition comprising at least 1, preferably at least 2, preferably at least 3, preferably at least 4, preferably at least 5, preferably at least 6, preferably at least 7, preferably at least 8, preferably at least 9, or preferably at least 10 antibacterial peptides of the invention, each of which comprises a bioactive fragment of SEQUENCE ID NO: 6 or a homolog thereof. Preferably, the composition comprises a first antibacterial peptide comprising a bioactive fragment selected from SEQUENCE ID NO 33-35, and a second antibacterial peptide comprising a bioactive fragment selected from SEQUENCE ID NO 33-35 and 74-80.

Homologs of Rice Protein 3 (SEQUENCE ID NO: 6) include glutelin (Oryza sativa Japonica Group), Glutelin precursor (zizania latifolia) anmd globulin (avena sativa) (SEQ ID NO: 50-52).

The invention also provides a composition comprising at least one and preferably a plurality of antibacterial peptides of the invention, wherein each of the peptides of the invention comprises an antibacterial fragment of a protein disclosed herein, typically selected from SEQUENCE ID NO: 1 to 6 or a homolog thereof, or an antibacterial variant of the fragment.

Typically, the or each antibacterial peptide of the invention is selected from, or comprises, an antibacterial fragment selected from, SEQUENCE ID NO: 7-35 and 54-251, or an antibacterial variant of the fragment.

The invention also provides a composition comprising at least one and preferably a plurality of peptides of the invention, wherein the or each of the peptides of the invention comprises a fragment of a protein disclosed herein, typically selected from SEQUENCE ID NO: 1-3. Typically, the or each peptide of the invention is selected from, or comprises a fragment selected from, SEQUENCE ID NO: 7-25, or a variant of the fragment. The invention also provides a composition comprising substantially all of the fragments of SEQ ID NO's 7-25, or peptides comprising the fragments, or antibacterial variants of the fragments

The invention also provides a composition comprising at least one and preferably a plurality of peptides of the invention, wherein the or each of the peptides of the invention comprise a fragment of a protein disclosed herein, typically selected from SEQUENCE ID NO: 4-6. Typically, the or each peptide of the invention is selected from, or comprises a fragment selected from, SEQUENCE ID NO: 26-35, or a variant of the fragment. The invention also provides a composition comprising substantially all of the fragments of SEQ ID NO's 26-35, or peptides comprising the fragments, or antibacterial variants of the fragments.

Preferably, the composition comprises at least two distinct peptides of the invention.

Preferably, the composition comprises at least three distinct peptides of the invention.

Preferably, the composition comprises at least four distinct peptides of the invention.

Preferably, the composition comprises at least five distinct peptides of the invention.

Preferably, the composition comprises at least six distinct peptides of the invention.

Preferably, the composition comprises at least seven distinct peptides of the invention.

Preferably, the composition comprises at least eight distinct peptides of the invention.

Preferably, the composition comprises at least nine distinct peptides of the invention.

Preferably, the composition comprises at least ten distinct peptides of the invention.

In one embodiment, the invention comprises a composition comprising substantially all of fragments SEQUENCE ID NO: 81, 66-73, and 106-251, or peptides containing the fragments, or variants of the fragments, or a mixture of the fragments and variants.

In one embodiment, the invention comprises a composition comprising substantially all of fragments SEQUENCE ID NO: 74-80, 82-105, or peptides containing the fragments, or variants of the fragments, or a mixture of the fragments and variants.

In one embodiment, the composition comprises a surfactant. In one embodiment the surfactant is selected from a cationic surfactant, an anionic surfactant, a non-ionic surfactant, and a combination thereof. In one embodiment, the composition comprises a fragrance. In one embodiment, the composition includes an anti-perspirant agent. In one embodiment, the composition, the composition includes an oxidising agent (such as a bleach). In one embodiment, the composition is a liquid product. In one embodiment, the composition is a solid product. In one embodiment, the composition is a semi-solid product (for example a cream, lotion or gel). In one embodiment, the solid is a particulate product.

In one embodiment the composition is a personal care composition. Examples of personal care compositions include skincare products, cosmetics, hair cleaning or care products, dentrifices, mouthwashes, anti-perspirants, and deodorants. In one embodiment, the composition is a household cleaning product (to be understood to include industrial cleaning products, hard surface cleaning products, toilet cleaning products, dishwashing liquids, dishwashing tablets, fabric washing tablets). In one embodiment the composition is a plant biocide (i.e. for use in treating plants to kill microbial plant pathogens).

The invention also relates to a comestible product comprising a peptide or fragment of the invention. Preferably the comestible product is man-made.

The invention also relates to a comestible product comprising a composition of peptides or fragments of the invention. Preferably the comestible product is man-made.

Preferably, the comestible product is a food product for human or animal (mammalian) or cellular consumption.

In one embodiment the man-made comestible product is a sports nutrition product, for example a beverage, snack or supplement. In one embodiment the man-made comestible product is a beverage. In one embodiment the man-made comestible product is a bakery product. In one embodiment the man-made comestible product is a dairy product. In one embodiment the man-made comestible product is a snack product. In one embodiment the man-made comestible product is a baked extruded food product. In one embodiment the man-made comestible product is powdered milk. In one embodiment the man-made comestible product is an infant formula product. In one embodiment the man-made comestible product is a confectionary product. In one embodiment the man-made comestible product is a yoghurt. In one embodiment the man-made comestible product is a yoghurt drink. In one embodiment the man-made comestible product is an ice cream product. In one embodiment the man-made comestible product is a frozen food product. In one embodiment the man-made comestible product is a breakfast cereal. In one embodiment the man-made comestible product is a bread. In one embodiment the man-made comestible product is a flavoured milk drink. In one embodiment the man-made comestible product is a confectionary bar. In one embodiment the man-made comestible product is a tea or tea product. In one embodiment the man-made comestible product is a based extruded snack product. In one embodiment the man-made comestible product is a fried snack product. In one embodiment the man-made comestible product is a nutritional supplement. In one embodiment the man-made comestible product is a sports nutritional product. In one embodiment the man-made comestible product is a baby food product. In one embodiment the man-made comestible product is a speciality food product for immunocompromised individuals. In one embodiment the man-made comestible product is a food for geriatric patients.

The invention also relates to a peptide or composition of the invention for use in treating or preventing a bacterial infection in a mammal.

The invention also relates to a peptide or composition of the invention for use as an antimicrobial or antibacterial agent.

The invention also relates to a peptide or composition of the invention for use as a preservative.

The invention also relates to a peptide or composition of the invention for use as a preservative in a perishable product, such as a food product or a personal care composition.

The invention also relates to a peptide or composition of the invention for use as an anti-bacterial agent in a personal care composition.

The invention also relates to a peptide or composition of the invention for use as an anti-bacterial agent in a household cleaning product.

The invention also relates to a peptide or composition of the invention for use as a plant biocidal agent.

The invention also relates to a peptide of the invention for use in treatment or prevention of a disease or condition characterised by a bacterial infection. The invention also relates to a composition of peptides of the invention for use in treatment or prevention of a disease or condition characterised by a bacterial infection. In one embodiment, the bacterial infection is a MRSA infection.

The invention also relates to a pharmaceutical composition comprising a peptide of the invention in combination with a pharmaceutically acceptable carrier.

The invention also relates to a pharmaceutical composition comprising a composition of peptides of the invention in combination with a pharmaceutically acceptable carrier.

In one embodiment, the peptides, variants or fragments are bioactive. In one embodiment, the peptides, variants or fragments are anti-microbial.

The invention also relates to a comestible product, for example a food product comprising a peptide or composition of the invention, for example a dairy or non-dairy product, a solid food or a beverage, a food additive or supplement. The dairy product may be a milk, a cheese, or yoghurt. In one embodiment, the food product is a sports nutritional product. The food product may comprise any amount of the composition of the invention, for example from 0.1% to 30% (w/w).

The peptides of the invention are used in the topical cosmetic or pharmaceutical composition of this invention at cosmetically or pharmaceutically effective concentrations to achieve the desired effect; in a preferred form with regards to the total weight of the composition,

between 0.00000001% (in weight) and 20% (in weight); preferably between 0.000001% (in weight) and 15% (in weight), more preferably between 0.0001% (in weight) and 10% (in weight) and even more preferably between 0.0001% (in weight) and 5% (in weight). Ideally, the peptides of the present invention are preferably used from about 0.00001% w/w to about 0.5% w/w [0.1 to 5000 ppm], and more preferably from 0.00005 w/w to about 0.05 w/w [0.5 to 500 ppm], and most preferably from about 0.0001 w/w to about 0.01 w/w of the composition [1 to 100 ppm]. Ideally, the peptides of the present invention are preferably used from about 0.0001% w/w to about 0.004% w/w of the composition.

For compositions of peptides of the invention, a typical daily dosage may be 0.2g to 100g. However, when administered as a food for special medicinal purpose, or medical food, the daily dosage may be 50-500g per day.

The dosage of compositions of the invention for use in food products and food supplements (i.e. comestible compositions) will be broadly in the 0.2-100 g/day range. In one embodiment, the daily dosage is 1-10 g/day, ideally about 3-8 g/day. In one embodiment, the daily dosage is 10-20 g/day. In one embodiment, the daily dosage is 20-30 g/day. In one embodiment, the daily dosage is 30-40 g/day. In one embodiment, the daily dosage is 10-100 g/day. In one embodiment, the daily dosage is about 5 g/day, ideally about 3-8 g/day. In one embodiment, the dosage is 2-1000 mg/day/kg body weight. In one embodiment, the dosage is 10-500 mg/day/kg body weight. In one embodiment, the dosage is 10-100 mg/day/kg body weight. In one embodiment, the dosage is 30-70 mg/day/kg body weight. The dosage of peptides of the invention for food supplements may be 0.00001mg-0.01mg per day or dose.

The food product may be a Food for Specific Medicinal Purposes (FSMP) which is defined as foods that are specifically formulated, processed and intended for the dietary management of diseases, disorders or medical conditions of individuals who are being treated under medical supervision. These foods are intended for the exclusive or partial feeding of people whose nutritional requirements cannot be met by normal foods.

The invention also provides topical composition comprising a peptide of the invention. It will be appreciated that the topical composition may comprise a plurality of peptides, fragments and/or variants. In one embodiment, the topical composition comprises substantially all the peptides. In one embodiment, the topical composition comprises substantially all the variants.

The topical composition of the invention may be presented in a formulation selected from the group comprising creams, multiple emulsions, anhydrous compositions, aqueous dispersions, oils, milks, balsams, foams, lotions, gels, cream gels, hydro-alcoholic solutions, hydro-glycolic solutions, cosmetic, personal care product, hydrogels, liniments, sera, soaps, dusting powder, paste, semi solid formulations, liniments, serums, shampoo, conditioner, ointments, any rinse off formulation, talc, mousses, powders, sprays, aerosols, solutions, suspensions, emulsions, syrups, elixirs, polysaccharide films, patches, gel patches, bandages, an adhesive system, water-in-oil emulsions, oil-in-water emulsions, and silicone emulsions.

In an embodiment of the current invention, the emulsion contains a lipid or oil. The emulsion may be, but is not limited to, oil-in-water, water-in-oil, water-in-oil-in-water and oil-in-water-in-silcone emulsions. The emulsion may contain a humectant. The emulsion may contain an anti-foaming agent, such as silicone. The emulsion may have any suitable viscosity. Emulsions may further contain an emulsifier and/or an anti-foaming agent. Methods of preparing an emulsion are known to a person skilled in the art.

The topical composition of the invention may be incorporated into a medical device for administration. Such a device can include but is not limited to a fabric, patch, bandage, gauge, sock, tight, underwear, dressing, glove, mask, adhesive patches, non-adhesive patches, occlusive patches and microelectric patches or suitable adhesive system. In such an embodiment, the device is in direct contact with the keratinous layer such as the skin, thus releasing the peptides of the invention. It will be understood that the topical composition may be incorporated in any suitable form as detailed herein. For example, the topical composition or peptides of the invention can be incorporated into the device or be present on the surface of the device or can be in a cream, gel or wax formulation or any suitable formulation defined herein and incorporated into the device or on the surface of the device. The device may be adapted for adhesion or attachment to the skin.

In one embodiment the device is adapted to release a constant quantity of the composition or the peptides of the invention. It will be understood that the amount of the composition contained in the sustained release system will depend, for example, on where the composition is to be administered, the kinetics and duration of the release of the composition of the invention, as well as the nature of the condition, disorder and/or disease to be treated and/or cared for. The device may be such that the composition is released by biodegradation of the

device, or by friction between the device and the body, due to bodily moisture, the skin's pH or body temperature.

In an embodiment of the invention the topical composition may further comprise at least one cosmetically or pharmaceutically acceptable excipient. Excipient may be used interchangeably with functional ingredient or additive. It will be understood that although the topical compositions of the current invention can be administered alone, they will generally be administered in admixture with a cosmetic or pharmaceutical excipient. Cosmetically or pharmaceutically acceptable excipient are well known in the art and any known excipient, may be used provided that it is suitable for topical administration and is dermatologically acceptable without undue toxicity, incompatibility and/or allergic reaction.

Preferably any excipient included is present in trace amounts. The amount of excipient included will depend on numerous factors, including the type of excipient used, the nature of the excipient, the component(s) of the topical composition, the amount of active or peptide in the topical composition and/or the intended use of the topical composition. The nature and amount of any excipient should not unacceptably alter the benefits of the peptides of this invention.

In an embodiment of the invention the excipient may be a suitable diluent, carrier, binder, lubricant, suspending agent, coating agent, preservative, stabilisers, dyes, vehicle, solubilising agent, base, emollient, emulsifying agent, fragrance, humectant, and/or surfactants.

Examples of suitable diluents include, but are not limited to, any diluent disclosed in disclosed in US2014120131 or US2004132667. Examples include ethanol, glycerol and water.

Examples of suitable carriers include, but are not limited to, lactose, starch, glucose, methyl cellulose, magnesium stearate, mannitol, sorbitol and any suitable carrier disclosed in US2014120131 or US2004132667.

Examples of suitable binders include, but are not limited to, starch, gelatin, natural sugars such as glucose, anhydrous lactose, free-flow lactose, beta-lactose, corn sweeteners, natural and synthetic gums, such as acacia, tragacanth or sodium alginate, carboxymethyl cellulose

and polyethylene glycol and any suitable binder disclosed in US2014120131 or US2004132667.

Examples of suitable lubricants include, but are not limited to, sodium oleate, sodium stearate, magnesium stearate, sodium benzoate, sodium acetate, and sodium chloride and any suitable lubricant disclosed in US2014120131 or US2004132667.

The carrier may be any suitable carried known in the art or disclosed in US2014120131 or US2004132667. In some embodiments, the carrier may include, but is not limited to, a liquid, such as water, oils or surfactants, including those of petroleum, animal, plant or synthetic origin, polymer, oil, such as peanut oil, mineral oil, castor oil, soybean oil, alcohol, polysorbates, sorbitan esters, ether sulfates, sulfates, betaines, glycosides, maltosides, fatty alcohols, nonoxynols, poloxamers, polyoxyethylenes, polyethylene glycols, dextrose, glycerol, or digitonin. It will be understood that the carrier will be dermatologically acceptable. Preferred carriers contain an emulsion such as oil-in-water, water-in-oil, water-in-oil-in-water and oil-in-water-in-silicone emulsions. Emulsions may further contain an emulsifier and/or an anti-foaming agent.

In an embodiment of the invention, the topical composition may further comprise one or more additional ingredients. The topical composition of the invention may be administered consecutively, simultaneously or sequentially with the one or more other additional agents. Such additional ingredients may be those of benefit to include in a topical composition, or of benefit depending on the intended use of the topical composition. The additional ingredient may be active or functional or both.

Examples of such additional ingredients include, but are not limited to, one or more of cleaning agents, conditioning agents, sunscreen, pigment, moisturiser, thickening agents, gelling agents, essential oil, astringents, pigments, anti-caking agent, anti-foaming agent, binders, additives, buffers, chelating agents, external analgesics, film formers or materials, bulking agents, polymers, opacifying agents, pH adjusters, propellants, reducing agents, sequestrants, skin bleaching and lightening agents, skin conditioning agents, aloe vera, healing agents, soothing agents, smoothing agents, pantothenic acid, treating agents, thickeners, vitamins. colourants, pharmaceuticals, antiseptic agents, antifoaming agents,

buffering agents, astringents, polymers, pH adjuster, deodorant or any other dermatologically acceptable carrier or surfactant.

It is to be understood that additional ingredients listed may provide more than one benefit. The classification given herein is for clarity and convenience only and not intended to limit the additional ingredient to that particular application or category listed.

Any additional ingredients should be suitable for application to the skin without undue toxicity, incompatibility and/or allergic reaction.

In some embodiments, the additional ingredient has glucose transport activity or aids glucose transport activity. In some embodiments, the additional ingredient has anti-inflammatory activity or aids anti-inflammatory activity. In some embodiments, the additional ingredient has anti-aging activity or aids anti-aging activity. In some embodiments, the additional ingredient is for keratinous layer health and/or development, skin health and/or development, and/or muscle health, recovery and/or development. The active agent may be a pharmacological enhancer. Such active agents are known and available on the market. In such cases, the topical composition of the invention may be administered consecutively, simultaneously or sequentially with the one or more other active agents.

In some embodiments, the additional ingredient may be farnesol ([2E, 6E], -3, 7, 11,-trimethyl-2, 6, 10, dodecatrien-1-ol), phytantriol (3, 7, 11, 15, tetramethylhexadecane-1, 2, 3, -triol), desquamation actives, enzymes, enzyme inhibitors, enzyme activators, botanical extracts and marine extracts, anti-acne actives, anti-wrinkle or anti atrophy actives, anti-oxidant/radical scavengers, chelators, flavonoids, anti-inflammatory agents, anti-cellulite agents, topical anaesthetics, tanning actives, skin lightening agents, skin healing agents, bisabolol, antimicrobial or antifungal active, sunscreen actives, particulate material, conditioning agents, structuring agents, thickening agent,

The desquamation active may be any suitable agent that enhances the skin appearance or texture of the skin and is as disclosed in US2014120131 or US2004132667.

Examples of anti-acne actives are as disclosed in US2014120131 or US2004132667 and include, resorcinol, salicylic acid, erythromycin, zine, sulfur, benzoyl peroxides.

Examples of thickening agents are as disclosed in US2014120131 or US2004132667 and include carboxylic acid polymers, crosslinked polyacrylate polymers, polyacrylamide polymers, polysaccharides.

Examples of conditioning agents are as disclosed in US2014120131 or US2004132667 and include humectants, moisturiser or skin conditioner.

Examples of structuring agents are as disclosed in US2014120131 or US2004132667 and include any agent that provide rheological characteristics to the composition and contributes to the stability of the composition.

Any suitable antimicrobial or antifungal active may be used and examples are as disclosed in US2014120131 or US2004132667. Such actives are capable of destroying microbes, preventing growth or action of microbes. Examples include but are not limited to β-lactam drugs, quinolone drugs, tetracycline, erythromycin, streptomycin sulfate, salicylic acid, benzoyl peroxide.

Examples of a particulate material include metallic oxide. Examples of anti-cellulite agents include xanthine agents. Examples of tanning actives includes 1, 3-dihydroxy-2-propanone and those disclosed in US2014120131 or US2004132667. Examples of topical anaesthetics include benzocaine, lidocaine and bupivacaine and those disclosed in US2014120131 or US2004132667.

Examples of skin lightening agents include any agent known in the art such as kojic acid, ascorbic acid and those disclosed in US2014120131 or US2004132667.

Examples of sunscreen actives include any suitable organic or inorganic sunscreen active. Examples include metallic oxides, 2-ethylhexyl-p-methoxycinnamate and those disclosed in US2014120131 or US2004132667.

Examples of skin healing agents includes panthenoic acid as disclosed in US2014120131 or US2004132667.

Examples of anti-inflammatory agents include any agent that enhances the skin appearance, tone or colour and include but are not limited to corticosteroids, hydrocortisone, non-steroidal agents such as ibuprofen and aspirin and those disclosed in US2014120131 or US2004132667.

Examples of flavonoids includes flavanones, methoxy flavonones, unsubstituted chalcone and mixtures thereof and those disclosed in US2014120131 or US2004132667.

Examples of enzymes include lipases, proteases, catalase, super oxide-dismutase, amylase, peroxidase, glucuronidase, ceramidases, hyaluronidases. Examples of enzyme inhibitors include trypsine inhibitors, Bowmann Birk inhibitors, chymotrypsin inhibitors, botanical extracts, flavonoids, quercetin chalcone and those disclosed in US2014120131 or US2004132667 and mixtures thereof. Examples of enzyme activators include coenzyme A, Q10 (ubiquinone), glycyrrhizin, berberine, chrysin and those disclosed in US2014120131 or US2004132667 and mixtures thereof

Examples of anti-wrinkle or anti atrophy actives include sulfur containing D and L amino acids, particular, N-acyl derivatives such as N-acetyl-L-cysteine, hydroxyl acids, phytic acid, lipoic acid, lysophosphatidic acid, skin peel agents, vitamin B3, retinoids and those disclosed in US2014120131 or US2004132667 and mixtures thereof.

The anti-oxidant/radical scavenger agent may be any agent that is useful for providing protection against UV radiation or other environmental agents which may cause skin damage such as those disclosed in US2014120131 or US2004132667. Examples of anti-oxidant/radical scavengers include ascorbic acid, its salts and derivatives (vitamin C), tocopherol its salts and derivatives (vitamin E), butylated hydroxyl benzoic acids and their salts, peroxides, gallic acids and alkyl esters, sorbic acid, lipoic acid, amines, lycine pidolate, arginine pilolate, nordihydroguaiaretic acid, bioflavonoids, curcumin, lysine, methionine, proline, superoxide dismutase, silymarin, tea extracts and mixtures thereof.

Examples of chelators include EDTA, NTA, hydoxamic acids, phytic acid, lactoferrin and those disclosed in US2014120131 or US2004132667 and mixtures thereof. A chelator means an agent capable of removing a metal ion by forming a complex so that the metal ion cannot participate in or catalyse chemical reactions. A chelator is useful for protection against UV radiation or other environmental agents that can cause skin damage.

It will be appreciated that a plurality of additional ingredients may be added. The amount of the additional ingredient may be from about 0.001% to about 50% weight of the composition, preferably, about 0.01% to about 20%, preferably about 0.1% to about 10%, about 0.5% to about 10%, about 1% to about 5%, preferably 2% weight of the composition. The amount of additional ingredient included will depend on numerous factors, including the type of

additional ingredient used, the nature of the additional ingredient, the component(s) of the topical composition, the amount of active or peptide in the topical composition and/or the intended use of the topical composition. The nature and amount of any additional ingredient should not unacceptably alter the benefits of the peptides of this invention.

The topical composition may be alcohol free.

In some embodiments of the invention, the composition further comprises one or more additional active agents, in addition to the peptide of the invention (also known as the active of the composition). In addition, or alternatively, the composition may be administered with one or more other additional active agents. Typical said additional active agent is present in trace amounts only. In some embodiments, there may be no additional active agent present in the composition. The amount of additional active agent included will depend on numerous factors, including the type of additional active agent used, the nature of the additional active agent, the component(s) of the topical composition, the amount of active or peptide in the topical composition and/or the intended use of the topical composition. The nature and amount of any additional active agent should not unacceptably alter the benefits of the peptides of this invention.

It is to be understood that an ingredient that is considered to be an "active" ingredient in one product may be a "functional" or "excipient" ingredient in another and vice versa. It will also be appreciated that some ingredients play a dual role as both an active ingredient and as a functional or excipient ingredient.

Examples of the additional active agents include glucose transport promoting drugs, skin supplement, agent for treatment and/or care of the skin, anti-inflammatory agent, an anti-aging agent, a cellular growth promoting agent and pharmacological enhancers. Such agents are well known in the art and it will be appreciated that any suitable additional active agent may be used. Additional active agents for treatment and/or care of the skin may include collagen synthesis agents, retinoids, exfoliating agents, anti-cellulite agents, elastase inhibiting agents, melanin synthesis stimulating or inhibiting agents, self-tanning agents, antiaging agents, antimicrobial agents, antifungal agents, fungistatic agents, bactericidal agents, and healing agents. Active agents also include anti-inflammatory agents.

Any additional active agent should be suitable for application to the skin without undue toxicity, incompatibility and/or allergic reaction.

It will be understood that the classification given herein is for clarity and convenience only and not intended to limit the additional ingredient, excipient, or active to that particular application or category listed.

In a particularly preferred embodiment, the methods and uses of the invention involve administration of a peptide or composition of the invention in combination with one or more other active agents, for example, existing growth promoting drugs or pharmacological enhancers available on the market. In such cases, the compounds of the invention may be administered consecutively, simultaneously or sequentially with the one or more other active agents.

The effect of the current invention is accomplished by topical application or administration of the topical composition of the invention described herein to a person, animal or a patient in need of treatment or care. Topical delivery preferably means delivery to a keratinous layer such as the skin, hair and/or nails, but can also mean delivery to a body lumen lined with epithelial cells, for example the lungs or airways, the gastrointestinal tract, the buccal cavity. The effect may be confined to the surface of the skin or may be within the skin or a combination of both.

The topical composition of the invention is administered in a cosmetically or pharmaceutically effective amount. In other words, in an amount that is non-toxic but sufficient amount to provide the desired effect. It will be appreciated that a person skilled in the art would be capable of determining an appropriate dose of the topical compositions of the invention to administer without undue experimentation. Alternatively, a physician will determine the actual dose that is most suitable for a patient depending on the particular condition, disease or disorder to be treated or cared for and the age, body weight and/or health of the person. It will depend on a variety of factors including the activity of the specific compound employed, the metabolic stability and length of action of that compound, the age, body weight, general health, sex, diet, mode and time of administration, rate of excretion, drug combination, the severity of the particular condition, and the individual undergoing therapy. There can, of course, be individual instances where higher or lower

dosage ranges are merited, and such are within the scope of this invention. For example, the composition may be administered at a dose of from 0.01 to 50 mg/kg body weight, such as from 0.1 to 30 mg/kg, more preferably from 0.1 to 20 mg/kg body weight, more preferably from 0.1 to 10 mg/kg body weight, preferably 0.1 to 5mg/kg body weight. In an exemplary embodiment, one or more doses of 10 to 300 mg/day or more preferably, 10 to 150 mg/day, will be administered to the patient. The amount and the frequency is as best suited to the purpose. The frequency of application or administration can vary greatly, depending on the needs of each subject, with a recommendation of an application or administration range from once a month to ten times a day, preferably from once a week to four times a day, more preferably from three times a week to three times a day, even more preferably once or twice a day.

In preferred embodiments, repeated use of the topical composition is provided.

The topical composition may be applied by, but not limited to, rubbing, or massaging into the keratinous tissue, skin or area of the body to be treated or cared for. In some embodiments, the composition is left on or not removed from the area of the body. In other embodiments, the composition is removed after a period of time, such as, but not limited to, from about 2 minutes to 60 minutes, from about 5 minutes to about 30 minutes, preferably from about 10 minutes to about 20 minutes. The composition may be removed immediately after application. In some embodiments of the current invention, the composition of the invention may be applied to an area to be treated by means to achieve a greater penetration of the composition and/or peptide of the invention, such as, but not limited to, iontophoresis, sonophoresis, electroporation, microelectric patches, mechanical pressure, osmotic pressure gradient, occlusive cure, microinjections or needle-free injections by means of pressure, such as injections by oxygen pressure, or any combination thereof.

The peptides of the invention are used in the topical cosmetic or pharmaceutical composition of this invention at cosmetically or pharmaceutically effective concentrations to achieve the desired effect; in a preferred form with regards to the total weight of the composition, between 0.00000001% (in weight) and 20% (in weight); preferably between 0.000001% (in weight) and 15% (in weight), more preferably between 0.0001% (in weight) and 10% (in weight) and even more preferably between 0.0001% (in weight) and 5% (in weight).

In some embodiments of the current invention, the composition may be delivered via any one of liposomes, mixed liposomes, oleosomes, niosomes, ethosomes, millicapsules, capsules, macrocapsules, nanocapsules, nanostructured lipid carriers, sponges, cyclodextrins, vesicles, micelles, mixed micelles of surfactants, surfactant-phospholipid mixed micelles, millispheres, spheres, lipospheres, particles, nanospheres, nanoparticles,milliparticles, solid nanopartciles as well as microemulsions including water-in-oil microemulsions with an internal structure of reverse micelle and nanoemulsions microspheres, microparticles.

A variety of methods are available for preparing liposomes. See, e.g., Szoka et al., Ann. Rev. Biophys. Bioeng. 9:467 (1980), U.S. Pat. Nos. 4,186,183, 4,217,344, 4,235,871, 4,261,975, 4,485,054, 4,501,728, 4,774,085, 4,837,028, 4,235,871, 4,261,975, 4,485,054, 4,501,728, 4,774,085, 4,837,028, 4,946,787, PCT Publication No. WO 91/17424, Deamer & Bangham, Biochim. Biophys. Acta 443:629-634 (1976); Fraley, et al., PNAS 76:3348-3352 (1979); Hope et al., Biochim. Biophys. Acta 812:55-65 (1985); Mayer et al., Biochim. Biophys. Acta 858:161-168 (1986); Williams et al., PNAS 85:242-246 (1988); Liposomes (Ostro (ed.), 1983, Chapter 1); Hope et al., Chem. Phys. Lip. 40:89 (1986); Gregoriadis, Liposome Technology (1984) and Lasic, Liposomes: from Physics to Applications (1993)). Suitable methods include, for example, sonication, extrusion, high pressure/homogenization, microfluidization, detergent dialysis, calcium-induced fusion of small liposome vehicles and ether fusion methods, all of which are well known in the art.

These delivery systems may be adapted to achieve a greater penetration of the compound and/or peptides of the invention. This may improve pharmacokinetic and pharmacodynamics properties. The delivery system may be a sustained release system wherein the compound or peptide of the invention is gradually released during a period of time and preferably with a constant release rate over a period of time. The delivery systems are prepared by methods known in the art. The amount of peptide contained in the sustained release system will depend on where the composition is to be delivered and the duration of the release as well as the type of the condition, disease and/or disorder to be treated or cared for.

The topical composition of the invention may be for human or animal usage in human and veterinary medicine.

The topical composition of the invention may be used for pharmaceutical, personal care and/or cosmetic uses.

The composition can be used to treat or care for any disease, disorder or condition of the skin, including but not limited to, psoriasis, dermatitis, allergic dermatitis, eczema, spongiosis, edema, skin cancer, ulcers, acne, scars, cellulitis, elastosis, keratosis, rosacea, varicose veins, inflammatory disorders.

The topical composition may be used to for treating or caring for visible signs of aging including but not limited to wrinkles, stretch marks and dark circles, dryness, fine lines, age spots, red blotches, sagging skin, and conditions caused by sun exposure including sunburn, stress, pollution and/diet. The topical composition may also be used for delaying, slowing or inhibiting the skins or the onset of aging. The composition may be administered by a medical device, such as a plaster or a patch as described herein.

The topical composition may be used to treat or care for a wound in a mammal. In another embodiment, the topical composition is for use in the treatment or prevention of a disease or condition characterised by damaged epithelial cells or tissue, and/or damaged dermal or epithelial cells or tissue. The disease may be but is not limited to cancer and trauma.

The topical composition may be used to treat or care for any muscle condition, to improve, muscle status in a mammal, to promote recovery of muscle, typically following exercise, to maintain or restore muscle health (for example lean tissue mass) in a mammal, to enhance physical performance, in treatment or prevention of a disease or condition characterised by lethargy or low energy levels.

The topical composition may be used to promote growth of a tissue, promote growth of epithelial tissue, promote growth of skin, promote growth of an organ, promote growth of an organism. The skin can have a normal pathology and/or an abnormal pathology.

The topical composition may also be used to treat or care for any inflammatory disorder.

A further aspect of the invention relates to a pharmaceutical composition comprising a peptide of the invention or a composition of peptides of the invention, admixed with one or

more pharmaceutically acceptable diluents, excipients or carriers. Even though the peptides and compositions of the present invention can be administered alone, they will generally be administered in admixture with a pharmaceutical carrier, excipient or diluent, particularly for human therapy. The pharmaceutical compositions may be for human or animal usage in human and veterinary medicine. Examples of such suitable excipients for the various different forms of pharmaceutical compositions described herein may be found in the "Handbook of Pharmaceutical Excipients, 2nd Edition, (1994), Edited by A Wade and PJ Weller. In particular, formulations for topical delivery are described in Topical drug delivery formulations edited by David Osborne and Antonio Aman, Taylor & Francis, the complete contents of which are incorporated herein by reference. Acceptable carriers or diluents for therapeutic use are well known in the pharmaceutical art, and are described, for example, in Remington's Pharmaceutical Sciences, Mack Publishing Co. (A. R. Gennaro edit. 1985). Examples of suitable carriers include lactose, starch, glucose, methyl cellulose, magnesium stearate, mannitol, sorbitol and the like. Examples of suitable diluents include ethanol, glycerol and water. The choice of pharmaceutical carrier, excipient or diluent can be selected with regard to the intended route of administration and standard pharmaceutical practice. The pharmaceutical compositions may comprise as, or in addition to, the carrier, excipient or diluent any suitable binder(s), lubricant(s), suspending agent(s), coating agent(s), solubilising agent(s). Examples of suitable binders include starch, gelatin, natural sugars such as glucose, anhydrous lactose, free-flow lactose, beta-lactose, corn sweeteners, natural and synthetic gums, such as acacia, tragacanth or sodium alginate, carboxymethyl cellulose and polyethylene glycol. Examples of suitable lubricants include sodium oleate, sodium stearate, magnesium stearate, sodium benzoate, sodium acetate, sodium chloride and the like. Preservatives, stabilizers, dyes and even flavouring agents may be provided in the pharmaceutical composition. Examples of preservatives include sodium benzoate, sorbic acid and esters of p hydroxybenzoic acid. Antioxidants and suspending agents may be also used.

The peptide or composition of the invention may be adapted for topical, oral, rectal, parenteral, intramuscular, intraperitoneal, intra-arterial, intrabronchial, subcutaneous, intradermal, intravenous, nasal, vaginal, buccal or sublingual routes of administration. For oral administration, particular use is made of compressed tablets, pills, tablets, gellules, drops, and capsules. Preferably, these compositions contain from 1 to 250 mg and more preferably from 10-100 mg, of active ingredient per dose. Other forms of administration

comprise solutions or emulsions which may be injected intravenously, intra-arterial, subcutaneously, intradermally, intraperitoneally or intramuscularly, and which are prepared from sterile or sterilisable solutions. The pharmaceutical compositions of the present invention may also be in form of suppositories, vaginal rings, pessaries, suspensions, emulsions, lotions, ointments, creams, gels, sprays, solutions or dusting powders. The composition of the invention may be formulated for topical delivery. Topical delivery generally means delivery to the skin, but can also mean delivery to a body lumen lined with epithelial cells, for example the lungs or airways, the gastrointestinal tract, the buccal cavity. In particular, formulations for topical delivery are described in Topical drug delivery formulations edited by David Osborne and Antonio Aman, Taylor & Francis, the complete contents of which are incorporated herein by reference. Compositions or formulations for delivery to the airways are described in O'Riordan et al (Respir Care, 2002, Nov. 47), EP2050437, WO2005023290, US2010098660, and US20070053845. Composition and formulations for delivering active agents to the iluem, especially the proximal iluem, include microparticles and microencapsulates where the active agent is encapsulated within a protecting matrix formed of polymer or dairy protein that is acid resistant but prone to dissolution in the more alkaline environment of the ileum. Examples of such delivery systems are described in EP1072600.2 and EP13171757.1. An alternative means of transdermal administration is by use of a skin patch. For example, the active ingredient can be incorporated into a cream consisting of an aqueous emulsion of polyethylene glycols or liquid paraffin. The active ingredient can also be incorporated, at a concentration of between 1 and 10% by weight, into an ointment consisting of a white wax or white soft paraffin base together with such stabilisers and preservatives as may be required.

Injectable forms may contain between 10-1000 mg, preferably between 10-250 mg, of active ingredient per dose.

Compositions may be formulated in unit dosage form, i.e., in the form of discrete portions containing a unit dose, or a multiple or sub-unit of a unit dose.

A person of ordinary skill in the art can easily determine an appropriate dose of one of the instant compositions to administer to a subject without undue experimentation. Typically, a physician will determine the actual dosage which will be most suitable for an individual patient and it will depend on a variety of factors including the activity of the specific compound employed, the metabolic stability and length of action of that compound, the age, body weight, general health, sex, diet, mode and time of administration, rate of excretion,

drug combination, the severity of the particular condition, and the individual undergoing therapy. The dosages disclosed herein are exemplary of the average case. There can of course be individual instances where higher or lower dosage ranges are merited, and such are within the scope of this invention. Depending upon the need, the agent may be administered at a dose of from 0.01 to 30 mg/kg body weight, such as from 0.1 to 10 mg/kg, more preferably from 0.1 to 1 mg/kg body weight. In an exemplary embodiment, one or more doses of 10 to 300 mg/day or more preferably, 10 to 150 mg/day, will be administered to the patient for the treatment of an inflammatory disorder.

In a particularly preferred embodiment, the methods and uses of the invention involve administration of a peptide or composition of the invention in combination with one or more other active agents, for example, existing anti-inflammatory drugs or pharmacological enhancers available on the market. In such cases, the compounds of the invention may be administered consecutively, simultaneously or sequentially with the one or more other active agents.

In one embodiment of the invention, the peptide of the invention may be administered in the form of a conjugate comprising the peptide, and may optionally include a linker, and a partner molecule, for example a protein such as an antibody molecule intended to increase the half-life of the conjugate in-vivo. In one embodiment, the peptide may be modified to substitute one or more amino acids with amino acids employed to attach partner molecules. For example, an amino acid may be substituted with a lysine residue for the purpose of conjugating a partner molecule such as a PEG molecule.

Definitions

All publications, patents, patent applications and other references mentioned herein are hereby incorporated by reference in their entireties for all purposes as if each individual publication, patent or patent application were specifically and individually indicated to be incorporated by reference and the content thereof recited in full.

Where used herein and unless specifically indicated otherwise, the following terms are intended to have the following meanings in addition to any broader (or narrower) meanings the terms might enjoy in the art:

Unless otherwise required by context, the use herein of the singular is to be read to include the plural and vice versa. The term "a" or "an" used in relation to an entity is to be read to refer to one or more of that entity. As such, the terms "a" (or "an"), "one or more," and "at least one" are used interchangeably herein.

As used herein, the term "comprise," or variations thereof such as "comprises" or "comprising," are to be read to indicate the inclusion of any recited integer (e.g. a feature, element, characteristic, property, method/process step or limitation) or group of integers (e.g. features, element, characteristics, properties, method/process steps or limitations) but not the exclusion of any other integer or group of integers. Thus, as used herein the term "comprising" is inclusive or open-ended and does not exclude additional, unrecited integers or method/process steps.

As used herein, the term “disease” is used to define any abnormal condition that impairs physiological function and is associated with specific symptoms. The term is used broadly to encompass any disorder, illness, abnormality, pathology, sickness, condition or syndrome in which physiological function is impaired irrespective of the nature of the aetiology (or indeed whether the aetiological basis for the disease is established). It therefore encompasses conditions arising from infection, trauma, injury, surgery, radiological ablation, poisoning or nutritional deficiencies.

As used herein, the term "treatment" or "treating" refers to an intervention (e.g. the administration of an agent to a subject) which cures, ameliorates or lessens the symptoms of a disease or removes (or lessens the impact of) its cause(s) (for example, the reduction in accumulation of pathological levels of lysosomal enzymes). In this case, the term is used synonymously with the term “therapy”.

Additionally, the terms "treatment" or "treating" refers to an intervention (e.g. the administration of an agent to a subject) which prevents or delays the onset or progression of a disease or reduces (or eradicates) its incidence within a treated population. In this case, the term treatment is used synonymously with the term “prophylaxis”.

As used herein, an effective amount or a therapeutically effective amount of an agent defines an amount that can be administered to a subject without excessive toxicity, irritation, allergic

response, or other problem or complication, commensurate with a reasonable benefit/risk ratio, but one that is sufficient to provide the desired effect, e.g. the treatment or prophylaxis manifested by a permanent or temporary improvement in the subject's condition. The amount will vary from subject to subject, depending on the age and general condition of the individual, mode of administration and other factors. Thus, while it is not possible to specify an exact effective amount, those skilled in the art will be able to determine an appropriate "effective" amount in any individual case using routine experimentation and background general knowledge. A therapeutic result in this context includes eradication or lessening of symptoms, reduced pain or discomfort, prolonged survival, improved mobility and other markers of clinical improvement. A therapeutic result need not be a complete cure.

The term "human or animal" should be understood to include humans, mammals and other non-mammalian animals such as fish. The human may be an infant, toddler, child, adolescent, adult, or elderly human. In one embodiment of the invention, the human is an elderly person, for example aged 55 or more. In one embodiment, the human is an elderly person experiencing deterioration of lean tissue mass. In one embodiment, the human is a sportsperson. In one embodiment, the human is pregnant woman. In one embodiment, the human is suffering from lethargy or perceived lack of energy.

The term "peptide" used herein refers to a polymer composed of 5 to 50 amino acid monomers typically via peptide bond linkage. Peptides (including fragments and variants thereof) of and for use in the invention may be generated wholly or partly by chemical synthesis or by expression from nucleic acid. For example, the peptides of and for use in the present invention can be readily prepared according to well-established, standard liquid or, preferably, solid-phase peptide synthesis methods known in the art (see, for example, J. M. Stewart and J. D. Young, Solid Phase Peptide Synthesis, 2nd edition, Pierce Chemical Company, Rockford, Illinois (1984), in M. Bodanzsky and A. Bodanzsky, The Practice of Peptide Synthesis, Springer Verlag, New York (1984). When necessary, any of the peptides employed in the invention can be chemically modified to increase their stability. A chemically modified peptide or a peptide analog includes any functional chemical equivalent of the peptide characterized by its increased stability and/or efficacy in vivo or in vitro in respect of the practice of the invention. The term peptide analog also refers to any amino acid derivative of a peptide as described herein. A peptide analog can be produced by procedures that include, but are not limited to, modifications to side chains, incorporation of

unnatural amino acids and/or their derivatives during peptide synthesis and the use of cross-linkers and other methods that impose conformational constraint on the peptides or their analogs. Examples of side chain modifications include modification of amino groups, such as by reductive alkylation by reaction with an aldehyde followed by reduction with $NaBH_4$; amidation with methylacetimidate; acetylation with acetic anhydride; carbamylation of amino groups with cyanate; trinitrobenzylation of amino groups with 2, 4, 6, trinitrobenzene sulfonic acid (TNBS); alkylation of amino groups with succinic anhydride and tetrahydrophthalic anhydride; and pyridoxylation of lysine with pyridoxa-5'-phosphate followed by reduction with $NABH_4$. The guanidino group of arginine residues may be modified by the formation of heterocyclic condensation products with reagents such as 2,3-butanedione, phenylglyoxal and glyoxal. The carboxyl group may be modified by carbodiimide activation via o-acylisourea formation followed by subsequent derivatization, for example, to a corresponding amide. Sulfhydryl groups may be modified by methods, such as carboxymethylation with iodoacetic acid or iodoacetamide; performic acid oxidation to cysteic acid; formation of mixed disulphides with other thiol compounds; reaction with maleimide; maleic anhydride or other substituted maleimide; formation of mercurial derivatives using 4-chloromercuribenzoate, 4-chloromercuriphenylsulfonic acid, phenylmercury chloride, 2-chloromercuric-4-nitrophenol and other mercurials; carbamylation with cyanate at alkaline pH. Tryptophan residues may be modified by, for example, oxidation with N-bromosuccinimide or alkylation of the indole ring with 2-hydroxy-5-nitrobenzyl bromide or sulphonyl halides. Tryosine residues may be altered by nitration with tetranitromethane to form a 3-nitrotyrosine derivative. Modification of the imidazole ring of a histidine residue may be accomplished by alkylation with iodoacetic acid derivatives or N-carbethoxylation with diethylpyrocarbonate. Examples of incorporating unnatural amino acids and derivatives during peptide synthesis include, but are not limited to, use of norleucine, 4-amino butyric acid, 4-amino-3-hydroxy-5-phenylpentanoic acid, 6-aminohexanoic acid, t-butylglycine, norvaline, phenylglycine, ornithine, sarcosine, 4-amino-3-hydroxy-6-methylheptanoic acid, 2-thienyl alanine and/or D-isomers of amino acids. Peptide structure modification includes the generation of retro-inverso peptides comprising the reversed sequence encoded by D-amino acids.

"Modified peptide": In an embodiment of the invention the peptide is a modified peptide. The term modified peptide is used interchangeably with the term derivative of the peptide. The modified peptide includes a peptide which has been substituted with one or more groups as

defined herein. The modification may be any modified that provides the peptides and or the composition of the invention with an increased ability to penetrate a cell. The modification may be any modification that increases the half-life of the composition or peptides of the invention. In one embodiment, the group is a protecting group. The protecting group may be an N-terminal protecting group, a C-terminal protecting group or a side-chain protecting group. The peptide may have one or more of these protecting groups.The person skilled in the art is aware of suitable techniques to react amino acids with these protecting groups. These groups can be added by preparation methods known in the art, for example the methods as outlined in paragraphs [0104] to [0107] of US2014120141. The groups may remain on the peptide or may be removed. The protecting group may be added during synthesis. In an embodiment of the invention the peptides may be substituted with a group selected from one or more straight chain or branched chain, long or short chain, saturated, or unsaturated, substituted with a hydroxyl, amino, amino acyl, sulfate or sulphide group or unsubstituted having from 1 to 29 carbon atoms. N-acyl derivatives include acyl groups derived from acetic acid, capric acid, lauric acid, myristic acid, octanoic acid, palmitic acid, stearic acid, behenic acid, linoleic acid, linolenic acid, lipoic acid, oleic acid, isosteric acid, elaidoic acid, 2-ethylhexaneic acid, coconut oil fatty acid, tallow fatty acid, hardened tallow fatty acid, palm kernel fatty acid, lanolin fatty acid or similar acids. These may be substituted or unsubstituted. When substituted they are preferably substituted with hydroxyl, or sulphur containing groups such as but not limited to SO_3H, SH, or S-S. In an embodiment of the current invention, the peptide is R_1-X- R_2. R_1 and/or R_2 groups respectively bound to the amino-terminal (N-terminal) and carboxyl-terminal (C-terminal) of the peptide sequence. In one embodiment, the peptide is R_1-X. Alternatively, the peptide is X- R_2. Preferably, R_1 is H, C_{1-4} alkyl, acetyl, benzoyl or trifluoroacetyl;. X is the peptide of the invention; R_2 is OH or NH_2. In an embodiment, R_1 is selected from the group formed by H, a non-cyclic substituted or unsubstituted aliphatic group, substituted or unsubstituted alicyclyl, substituted or unsubstituted heterocyclyl, substituted or unsubstituted heteroarylalkyl, substituted or unsubstituted aryl, substituted or unsubstituted aralkyl, Tert-butyloxycarbonyl, 9-fluorenylmethyloxycarbonyl (Fmoc) and R_5-CO-, wherein R_5 is selected from the group formed by H, a non-cyclic substituted or unsubstituted aliphatic group, substituted or unsubstituted alicyclyl, substituted or unsubstituted aryl, substituted or unsubstituted aralkyl, substituted or unsubstituted heterocyclyl and substituted or unsubstituted heteroarylalkyl; R_2 is selected from the group formed by $-NR_3R_4$, $-OR_3$ and $-SR_3$, wherein R_3 and R_4 are independently selected from the group formed by H, a non-cyclic substituted or unsubstituted

aliphatic group, substituted or unsubstituted alicyclyl, substituted or unsubstituted heterocyclyl, substituted or unsubstituted heteroarylalkyl, substituted or unsubstituted aryl, and substituted or unsubstituted aralkyl; and with the condition that R_1 and R_2 are not α-amino acids. In accordance with another preferred embodiment, R_2 is $-NR_3R_4$, $-OR_3$ or $-SR_3$ wherein R_3 and R_4 are independently selected from the group formed by H, substituted or unsubstituted C_1-C_{24} alkyl, substituted or unsubstituted C_2-C_{24} alkenyl, Tert-butyloxycarbonyl, 9-fluorenylmethyloxycarbonyl (Fmoc), substituted or unsubstituted C_2-C_{24} alkynyl, substituted or unsubstituted C_3-C_{24} cycloalkyl, substituted or unsubstituted C_5-C_{24} cycloalkenyl, substituted or unsubstituted C_8-C_{24} cycloalkynyl, substituted or unsubstituted C_6-C_{30} aryl, substituted or unsubstituted C_7-C_{24} aralkyl, substituted or unsubstituted heterocyclyl ring of 3-10 members, and substituted or unsubstituted heteroarylalkyl of 2 to 24 carbon atoms and 1 to 3 atoms other than carbon wherein the alkyl chain is of 1 to 6 carbon atoms. Optionally, R_3 and R_4 can be bound by a saturated or unsaturated carbon-carbon bond, forming a cycle with the nitrogen atom. More preferably R_2 is $-NR_3R_4$ or $-OR_3$, wherein R_3 and R_4 are independently selected from the group formed by H, substituted or unsubstituted C_1-C_{24} alkyl, substituted or unsubstituted C_2-C_{24} alkenyl, substituted or unsubstituted C_2-C_{24} alkynyl, substituted or unsubstituted C_3-C_{10} cycloalkyl, substituted or unsubstituted C_6-C_{15} aryl and substituted or unsubstituted heterocyclyl of 3-10 members, substituted or unsubstituted heteroarylalkyl with a ring of 3 to 10 members and an alkyl chain of 1 to 6 carbon atoms. More preferably R_3 and R_4 are selected from the group formed by H, methyl, ethyl, hexyl, dodecyl, or hexadecyl. Even more preferably R_3 is H and R_4 is selected from the group formed by H, methyl, ethyl, hexyl, dodecyl, or hexadecyl. In accordance with an even more preferred embodiment, R_2 is selected from -OH and $-NH_2$. In accordance with another embodiment of this invention R_1 is selected from the group formed by H, acetyl, lauroyl, myristoyl or palmitoyl, and R_2 is $-NR_3R_4$ or $-OR_3$ wherein R_3 and R_4 are independently selected from H, methyl, ethyl, hexyl, dodecyl and hexadecyl, preferably R_2 is -OH or $-NH_2$. More preferably, R_1 is acetyl or palmitoyl and R_2 is $-NH_2$. In a preferred embodiment, the acyl group is bound to the N-terminal end of at least one amino acid of the peptide. In an embodiment of the invention, the peptide is modified to comprise a side chain protecting group. The side chain protecting group may be one or more of the group comprising benzyl or benzyl based groups, t-butyl-based groups, benzyloxy-carbonyl (Z) group, and allyloxycarbonyl (alloc) protecting group. The side chain protecting group may be derived from an achiral amino acid such as achiral glycine. The use of an achiral amino acid helps to stabilise the resultant peptide and also facilitate the facile synthesis route of the

present invention. Preferably, the peptide further comprises a modified C-terminus, preferably an amidated C-terminus. The achiral residue may be alpha-aminoisobutyric acid (methylalaine). It will be appreciated that the specific side chain protecting groups used will depend on the sequence of the peptide and the type of N-terminal protecting group used.

"Conjugate": In one embodiment of the invention the peptide is conjugated, linked or fused to a binding partner, for example one or more polyethylene glycol polymers or other compounds, such as molecular weight increasing compounds or lipophilic groups. The molecular weight increasing compound is any compound that will increase the molecular weight, typically by 10% to 90%, or 20% to 50% of the resulting conjugate and may have a molecular weight of between 200 and 20, 000, preferably between 500 and 10, 000. The molecular weight increasing compound may be PEG, any water-soluble(amphiphilic or hydrophilic) polymer moiety, homo or co-polymers of PEG, a monomethyl-subsitututed polymer of PEG (mPEG) and polyoxyethylene glycerol (POG), polyamino acids such as poly-lysine, poly-glutamic acid, poly-aspartic acid, particular those of L conformation, pharmacologically inactive proteins such as albumin, gelatin, a fatty acid, olysaccharide, a lipid amino acid and dextran. The polymer moiety may be straight chained or branched and it may have a molecular weight of 500 to 40000Da, 5000 to 10000 Da, 10000 to 5000, Da. The compound (binding partner) may be any suitable cell penetrating compound, such as tat peptide, penetratin, pep-1. The compound (binding partner) may be an antibody molecule. The compound (binding partner) may be a lipophilic moiety or a polymeric moiety. The lipophilic substituent and polymeric substituents are known in the art. The lipophilic substituent includes an acyl group, a sulphonyl group, an N atom, an O atom or an S atom which forms part of the ester, sulphonyl ester, thioester, amide or sulphonamide. The lipophilic moiety may include a hydrocarbon chain having 4 to 30 C atoms, preferably between 8 and 12 C atoms. It may be linear or branched, saturated or unsaturated. The hydrocarbon chain may be further substituted. It may be cycloalkane or heterocycloalkane. The peptide may be modified at the N-terminal, C-terminal or both. The polymer or compound (binding partner) is preferably linked to an amino, carboxyl or thio group and may be linked by N-termini or C-termini of side chains of any amino acid residue. The polymer or compound (binding partner) may be conjugated to the side chain of any suitable residue. The polymer or compound (binding partner) may be conjugated via a spacer. The spacer may be a natural or unnatural amino acid, succinic acid, lysyl, glutamyl, asparagyl, glycyl, beta-alanyl,

gamma-amino butanoyl. The polymer or compound (binding partner) may be conjugated via an ester, a sulphonyl ester, a thioester, an amide, a carbamate, a urea, a sulphonamide. A person skilled in the art is aware of suitable means to prepare the described conjugate.

The term "natural" as applied to a peptide means a peptide that includes (a) a fragment of a plant protein, typically rice or pea protein, or variants of pea protein including lentil, sweet pea, or chick pea or variants of rice protein including oat, grass, corn, wild rice and bananas, or (b) a variant of the fragment of a plant protein, for example an antibacterial fragment of a homolog of the plant protein. The peptides or fragments of the invention may be isolated from plant protein or made synthetically using methods known to a person skilled in the art and described herein.

"C-terminal domain" as applied to a fragment means the first three amino acids at the c-terminus of the fragment.

"N-terminal domain" as applied to a fragment means the last three amino acids at the n-terminus of the fragment.

"Bioactive" as applied to a peptide or fragment means having a biological activity when administered to a mammal. The biological activity may be a health promoting activity. Examples of biological activities include glucose transport promoting, anti-bacterial, anti-inflammatory, or cellular growth or proliferation promoting. In one embodiment, the term "bioactive" means antimicrobial or antibacterial.

"Antibacterial" or "antibacterial activity" as applied to a peptide or fragment means a peptide or fragment that is capable of visibly inhibiting the growth of a bacteria in the agar-plate based growth inhibition studies described below.

"Glucose transport promoting" or "glucose transport promoting activity" as applied to a peptide or fragment means a peptide or fragment that is capable of increasing GLUT4 translocation into skeletal muscle compared with an untreated control when employed at a concentration of 2μM in the *in-vitro* assay described below. Preferably the peptide or

fragment is capable of increasing GLUT4 translocation compared with an untreated control by at least 50% (i.e a relative unit increase in GLUT4 translocation of 1% to 1.5%).

"Anti-inflammatory" as applied to a peptide or fragment means a peptide or fragment that is capable of significantly reducing the secretion of TNFα by LPS-stimulated J774.2 macrophages (compared with untreated LPS-stimulated J774.2 macrophages) when the macrophages are treated with 100μM of the peptide or fragment. J774.2 macrophages were treated with 100μM of synthetic peptide for 24 hours and then stimulated with (A) LPS (10ng/ml) for five hours or (B) LPS (10ng/ml) for 5 hours followed by ATP (5mM) for one hour. Supernatant was collected and levels of TNFα were determined by ELISA.

"Cellular growth or proliferation promoting" as applied to a peptide or fragment means a peptide or fragment that is capable of increasing elastin production or cellular proliferation of human skin treated with a 20μM solution of peptide or fragment in the following assay. Skin explants were prepared from abdominal plastic surgery. Some explants were delipidated with alcohol to obtain a dehydrated skin. These explants were maintained in maintenance medium supplied by the provider Bioprédic International for 5 days. Test items are applied twice per day with 5μL per explant. At the end of the test, viabilities controls are realized with the MTT on two explants, the third explant is fixed in the formaldehyde 4% for histology and cell staining. For each time of analysis (D1 and D5), histologies on delipidated explants, treated explants with test items, the DMSO 0.3% control and water control, are performed. After receipt in the laboratory, each skin explant in the maintenance medium is delipidated with 5μL alcohol during 3 hours. After 3 hours, all skin explants are treated two per day with test items, and they are incubated at 37°C +/- 2°C, 5% CO2 for 1 day or 5 days. Integrity of the system is realized at day 1 and day 5 with a viability control with MTT. Histology is realized by the laboratory *Gredeco* and the immunostaining to elastin and Ki67 are realized by the same laboratory. Immunostaining to filaggrin is realized by the laboratory *Intertek.* The detection of elastin (rabbit monoclonal antibody, clone P15502, LSBio) is performed using an immunoperoxidase technique two layers (ABC kit, Vector Laboratories) and revealed by AEC (3-amino-9 -éthylcarbazole). The immunohistochemical staining intensity in the elastic fibers is evaluated using a semi-quantitative histological score. Epithelial proliferation was analyzed by immunohistochemistry using anti-Ki67 antibody. Immunodetection was performed using an indirect immunoperoxidase technique three layers, amplified (DAKO kit) and revealed by AEC (3-Amino-9-ethylcarbazole). Counting the

number of labeled cells (keratinocytes of the basal layer of the epidermis) is performed and provides the total number of basal cells to calculate the % of labeled cells. The specific staining of filaggrin is performed with an immunoperoxidase staining (ABC kit, Fisher). The intensity of immunohistochemical marker in the epidermis is evaluated relative to the negative control of the solvent (Water or DMSO 0.3%).

"Enriched in peptides having a molecular weight of less than 10 KD" as applied to a composition of the invention means that the dry weight % of peptides in the composition having a molecular weight of less than 10 KD is greater than the dry weight % of polypeptide/protein in the composition having a molecular weight of 10 KD or greater.

"Homolog" of a reference protein should be understood to mean a protein from a different species of plant having at least 60%, 70%, 80%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% sequence homology with the reference protein. Thus, for example, homologs of pea protein P13918 include:

>gi|137584|sp|P08438.1|VCL_VICFA RecName: Full=Vicilin; Flags: Precursor [Vicia faba]
>gi|22057|emb|CAA68559.1| vicilin [Vicia faba var. minor] >gi|383931031|gb|AFH56916.1| vicilin **[Vicia faba]**

>gi|502105533|ref|XP_004492829.1| PREDICTED: vicilin-like isoform X1 **[Cicer arietinum] ChickPea**

>gi|29539109|emb|CAD87730.1| allergen Len c 1.0101 **[Lens culinaris] Lentil**

A "variant" of an antibacterial fragment shall be taken to mean a fragment having an amino acid sequence that is substantially identical to the reference antibacterial fragment, and which has antibacterial activity as defined above. Thus, for example, the term should be taken to include fragments that are altered in respect of one or more amino acid residues. Preferably such alterations involve the insertion, addition, deletion and/or substitution of 5 or fewer amino acids, more preferably of 4 or fewer, even more preferably of 3 or fewer, most preferably of 1 or 2 amino acids only. Insertion, addition and substitution with natural and modified amino acids is envisaged. The variant may have conservative amino acid changes, wherein the amino acid being introduced is similar structurally, chemically, or functionally to that being substituted. Generally, the variant will have at least 70% amino acid sequence homology, preferably at least 80% sequence homology, more preferably at least 90% sequence homology, and ideally at least 95%, 96%, 97%, 98% or 99% sequence homology

with the reference antibacterial fragment. In this specification, the term "sequence identity" should be understand to comprise both sequence identity and similarity, i.e. a variant (or homolog) that shares 70% sequence identity with a reference sequence is one in which any 70% of aligned residues of the variant (or homolog) are identical to or conservative substitutions of the corresponding residues in the reference sequence across the entire length of the sequence. Sequence identity is the amount of characters which match exactly between two different sequences. Hereby, gaps are not counted and the measurement is relational to the shorter of the two sequences. In terms of "sequence homology", the term should be understood to mean that a variant (or homolog) which shares a defined percent similarity or identity with a reference sequence when the percentage of aligned residues of the variant (or homolog) are either identical to, or conservative substitutions of, the corresponding residues in the reference sequence and where the variant (or homolog) shares the same function as the reference sequence.

This alignment and the percent homology or sequence identity can be determined using software programs known in the art, for example, one alignment program is BLAST, using default parameters. Details of these programs can be found at the following Internet address: http://www.ncbi.nlm.nih.gov/blast/Blast.cgi.

The term "variant" should also be taken to include fragments of peptides of the invention. A fragment of a peptide of the invention" or "peptide fragment" may have at least 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 or 22 amino acids and typically has a bioactivity, for example anti-inflammatory activity, anti-ageing activity, glucose transport promoting activity, or anti-bacterial activity. In one embodiment, the fragment consists of at least 30%, 40%, 50%, 60%, 70%, 80%, or 90% of the reference sequence. Typically the fragment is 9-12 contiguous amino acids in length. Generally, the fragment has a charge of between -1 and 0. The charge of a peptide, fragment or region is determined using the method of Cameselle, J.C., Ribeiro, J.M., and Sillero, A. (1986). Derivation and use of a formula to calculate the net charge of acid-base compounds. Its application to amino acids, proteins and nucleotides. Biochem. Educ. *14*, 131–136.

"Consisting essentially of" as applied to a plurality of peptides means substantially all of the peptides, for example at least 60%, 70%, 80% or 90% of the peptides.

"Pharmaceutical compositions": A further aspect of the invention relates to a pharmaceutical composition comprising a peptide of the invention or a composition of peptides of the invention, admixed with one or more pharmaceutically acceptable diluents, excipients or carriers. Even though the peptides and compositions of the present invention can be administered alone, they will generally be administered in admixture with a pharmaceutical carrier, excipient or diluent, particularly for human therapy. The pharmaceutical compositions may be for human or animal usage in human and veterinary medicine. Examples of such suitable excipients for the various different forms of pharmaceutical compositions described herein may be found in the "Handbook of Pharmaceutical Excipients, 2nd Edition, (1994), Edited by A Wade and PJ Weller. In particular, formulations for topical delivery are described in Topical drug delivery formulations edited by David Osborne and Antonio Aman, Taylor & Francis, the complete contents of which are incorporated herein by reference. Acceptable carriers or diluents for therapeutic use are well known in the pharmaceutical art, and are described, for example, in Remington's Pharmaceutical Sciences, Mack Publishing Co. (A. R. Gennaro edit. 1985). Examples of suitable carriers include lactose, starch, glucose, methyl cellulose, magnesium stearate, mannitol, sorbitol and the like. Examples of suitable diluents include ethanol, glycerol and water. The choice of pharmaceutical carrier, excipient or diluent can be selected with regard to the intended route of administration and standard pharmaceutical practice. The pharmaceutical compositions may comprise as, or in addition to, the carrier, excipient or diluent any suitable binder(s), lubricant(s), suspending agent(s), coating agent(s), solubilising agent(s). Examples of suitable binders include starch, gelatin, natural sugars such as glucose, anhydrous lactose, free-flow lactose, beta-lactose, corn sweeteners, natural and synthetic gums, such as acacia, tragacanth or sodium alginate, carboxymethyl cellulose and polyethylene glycol. Examples of suitable lubricants include sodium oleate, sodium stearate, magnesium stearate, sodium benzoate, sodium acetate, sodium chloride and the like. Preservatives, stabilizers, dyes and even flavouring agents may be provided in the pharmaceutical composition. Examples of preservatives include sodium benzoate, sorbic acid and esters of p-hydroxybenzoic acid. Antioxidants and suspending agents may be also used.

The peptide or composition of the invention may be adapted for topical, oral, rectal, parenteral, intramuscular, intraperitoneal, intra-arterial, intrabronchial, subcutaneous, intradermal, intravenous, nasal, vaginal, buccal or sublingual routes of administration. For oral administration, particular use is made of compressed tablets, pills, tablets, gellules,

drops, and capsules. Preferably, these compositions contain from 1 to 250 mg and more preferably from 10-100 mg, of active ingredient per dose. Other forms of administration comprise solutions or emulsions which may be injected intravenously, intra-arterial, subcutaneously, intradermally, intraperitoneally or intramuscularly, and which are prepared from sterile or sterilisable solutions. The pharmaceutical compositions of the present invention may also be in form of suppositories, vaginal rings, pessaries, suspensions, emulsions, lotions, ointments, creams, gels, sprays, solutions or dusting powders. The composition of the invention may be formulated for topical delivery. Topical delivery generally means delivery to the skin, but can also mean delivery to a body lumen lined with epithelial cells, for example the lungs or airways, the gastrointestinal tract, the buccal cavity. In particular, formulations for topical delivery are described in Topical drug delivery formulations edited by David Osborne and Antonio Aman, Taylor & Francis, the complete contents of which are incorporated herein by reference. Compositions or formulations for delivery to the airways are described in O'Riordan et al (Respir Care, 2002, Nov. 47), EP2050437, WO2005023290, US2010098660, and US20070053845. Composition and formulations for delivering active agents to the iluem, especially the proximal iluem, include microparticles and microencapsulates where the active agent is encapsulated within a protecting matrix formed of polymer or dairy protein that is acid resistant but prone to dissolution in the more alkaline environment of the ileum. Examples of such delivery systems are described in EP1072600.2 and EP13171757.1. An alternative means of transdermal administration is by use of a skin patch. For example, the active ingredient can be incorporated into a cream consisting of an aqueous emulsion of polyethylene glycols or liquid paraffin. The active ingredient can also be incorporated, at a concentration of between 1 and 10% by weight, into an ointment consisting of a white wax or white soft paraffin base together with such stabilisers and preservatives as may be required.

Injectable forms may contain between 10-1000 mg, preferably between 10-250 mg, of active ingredient per dose. Compositions may be formulated in unit dosage form, i.e., in the form of discrete portions containing a unit dose, or a multiple or sub-unit of a unit dose.

A person of ordinary skill in the art can easily determine an appropriate dose of one of the instant compositions to administer to a subject without undue experimentation. Typically, a physician will determine the actual dosage which will be most suitable for an individual patient and it will depend on a variety of factors including the activity of the specific compound employed, the metabolic stability and length of action of that compound, the age,

body weight, general health, sex, diet, mode and time of administration, rate of excretion, drug combination, the severity of the particular condition, and the individual undergoing therapy. The dosages disclosed herein are exemplary of the average case. There can of course be individual instances where higher or lower dosage ranges are merited, and such are within the scope of this invention. Depending upon the need, the agent may be administered at a dose of from 0.01 to 30 mg/kg body weight, such as from 0.1 to 10 mg/kg, more preferably from 0.1 to 1 mg/kg body weight. In an exemplary embodiment, one or more doses of 10 to 300 mg/day or more preferably, 10 to 150 mg/day, will be administered to the patient for the treatment of an inflammatory disorder.

In a particularly preferred embodiment, the methods and uses of the invention involve administration of a peptide or composition of the invention in combination with one or more other active agents, for example, existing antibacterial drugs or pharmacological enhancers available on the market. In such cases, the compounds of the invention may be administered consecutively, simultaneously or sequentially with the one or more other active agents.

In one embodiment of the invention, the peptide of the invention may be administered in the form of a conjugate comprising the peptide, a linker, and an antibody molecule intended to increase the half-life of the conjugate in-vivo.

"Man-made" as applied to comestible products should be understood to mean made by a human being and not existing in nature.

"Disease or condition characterised by bacterial infection" means any condition or disease characterised having a pathology caused by growth of bacteria or by bacterial infection, including for example MRSA, salmonella, listeria, bacterial pneumonia, Staphylococcal food poisoning, bacterial memingitis. Specific examples are provided in https://en.wikipedia.org/wiki/List_of_infectious_diseases.

"Improving muscle status" means improving the muscle health, for example promoting skeletal muscle protein synthesis, skeletal glucose absorbtion, improving lean tissue mass in therapeutic or non-therapeutic context, promoting muscle recovery generally after activity exercise, or improving muscle performance. The methods or uses may be therapeutic or non-therapeutic. The term "improving lean tissue mass status" should be understood to mean

increasing lean tissue mass, or inhibiting or preventing the rate of lean tissue mass degradation.

"Promoting muscle recovery" means causing an increase in absorbtion of glucose in skeletal muscle compared with untreated skeletal muscel.

"Disease or condition characterised by lethargy or low energy levels" means any condition or disease characterised by a feeling or tiredness or low energy. Examples include allergies, asthma, anemia, cancer and its treatments, chronic pain, heart disease, infection, depression, eating disorders, grief, sleeping disorders, thyroid problems, medication side effects, alcohol use, or drug use.

"Maintaining or restoring muscle health" means helping retain or restore mammalian muscle health resulting from damage incurred during exercise. By promoting glucose transport in skeletal muscle the peptides promote recovery from exercise, and relieve muscle soreness/pain and injury connected with exercise. They can also be used to decrease and prevent muscle cramping, and to allow a faster recovery from muscle cramping. Cramping can result from physical stress, mental stress, and or Repetitive Strain Injury stress. By promoting glucose transport the peptides help reduce Myopathy of the muscle, and help prevent Sarcopenia in mammals, promote recovery from injuries during exercise, and relieve muscle soreness/pain and injury connected with exercise. The invention also relates to a peptide or composition of the invention for use in maintaining or restoring muscle health in a mammal.

"Metabolic disorder characterised by dysregulated glucose or insulin levels in a mammal" should be understood to include pre-diabetes, diabetes; Type-1 diabetes; Type-2 diabetes; metabolic syndrome; obesity; diabetic dyslipidemia; hyperlipidemia; hypertension; hypertriglyceridemia; hyperfattyacidemia; hypercholerterolemia; hyperinsulinemia, MODY, and HNF1A-MODY.

"Improving glycaemic management" should be understood to mean one or more of lowering plasma blood glucose levels, especially post-prandial blood glucose levels, treating or

preventing hyperglycaemia, increasing post prandial insulin secretion, regulating glucose homeostasis, and reducing or attenuating insulin resistance.

In the specification the terms "comprise, comprises, comprised and comprising" or any variation thereof and the terms "include, includes, included and including" or any variation thereof are considered to be totally interchangeable and they should all be afforded the widest possible interpretation and vice versa.

Brief Description of the Figures

Figure 1. Agar Diffusion Assay. The activity of the peptide composition E_2_AM was determined against S. aureus (A), Salmonella Typhimurium (B), P. aeruginosa (C) and E. coli (D). The arrow highlights the position of the peptide on the disk.

Figure 2. Effect of peptide composition E_2_AM on the growth of P. aeruginosa. Growth curves were conducted in Mueller Hinton at pH7 over 24 hours using a Synergy H1 plate reader. Data was then analysed using the Gen5 Software.

Figure 3. Total viable counts after 72 hours in P. aeruginosa inoculated orange juice. The red line shows the inoculated control and the purple, blue and orange show decreasing concentrations of peptide composition E_2_AM. Plates were read in a Synergy H1 plate reader

Figure 4: Total viable counts after 72 hours in P. aeruginosa (left) and E. coli (right) inoculated milk at 37 degrees. Peptide composition E_2_AM is included at 5mg/mL in blue. Plates were read in a Synergy H1 plate reader every 24 hours.

Figure 5: Plate Count assay with Minced beef. Plates 1 & 2 show a bacterial count of 1x10 -1 CFU/mL and plates 3 & 4 are 1x10 -4 CFU/mL dilution with control (left) and peptide (right) at 37 degrees after 72 hours

Figures 6A and 6B are pictures of agar plates in which E Coli ATCC25922 is growing showing an inhibition zone (9-10mm) obtained with peptide I_87_SF (arrow). Control antibiotic discs (TET and CIP) were placed in the centre of each plate.

Figures 7A and 7B are pictures of agar plates in which Acinetobacter baumannii 19606 is growing, No antibacterial activity was detected. Control antibiotic discs (TET and CIP) were placed in the centre of each plate.

Figures 8A and 8B are pictures of agar plates in which MRSA 4330 is growing showing an inhibition zone (18mm) obtained with peptide I_87_SF (arrow). Control antibiotic discs (TET and CIP) were placed in the centre of each plate.

Detailed Description of the Invention

EXPERIMENTAL

EXAMPLE 1

The anti-bacterial effects of peptide compositions of the invention were tested. The compositions are:

E_1_AM Contains substantially all of SEQ ID 106-251, 81, 68, 66, 106 and 107

E_2_AM Contains substantially all of SEQ ID 106-251, 81 and 68

Minimum Inhibitory Concentrations and Zone of Inhibition

MIC and MBC assays were carried out in Mueller Hinton broth previously adjusted to pH5, 7 and 9 and inoculated with 1x105 CFU/mL of each bacteria. The values shown represent the mean of three replicates performed on three independent days. Concentrations necessary to inhibit and completely halt growth are consistently lower in all strains at pH5. As the pH increases so too does the MIC and MBC suggesting that the bioactivity is improved in acidic conditions. This may be as a result of these conditions inducing a favourable isoelectric point an therefore, and enhanced electrostatic interaction between the positively charged hydrolysate and the negatively charged bacterial membrane. The zones of inhibition shown are the mean of three independent replicate experiments with the standard deviation. Values range from ~11mm to ~21mm with the best activity observed in P. aeruginosa. Each well is 8mm in diameter alone and studies were conducted in Mueller Hinton agar at pH7.

Growth Curve in Mueller Hinton Broth pH7 at 37 degrees over 24 hours (Fig 2) and Total viable counts of P. aeruginosa in peptide treated orange juice over 72 hours (Fig 3)

The peptide composition interferes with the growth of P. aeruginosa. At a concentration of 1024 µg/mL, sh_0MBH9Q extended the lag-time of P. aeruginosa by ~10 hours. Concentrations above this resulted in complete cell death. This value corresponds to the MBC determined at pH7.

Fresh orange juice was inoculated with P. aeruginosa at 1x105 CFU/mL and plates were read at selected time points. Increased reduction in the microbial population appears to be linear with the increasing concentration of the peptide composition continues to reduce counts of P. aeruginosa over time and induces a ~1.2 log reduction at 4096 µg/mL after 72 hours

Total viable counts after 72 hours in P. aeruginosa (Fig. 4 left) and E. coli (Fig. 4 right) inoculated milk at 37 degrees

The plate count study was conducted with peptide compositions at a concentration of 5mg/mL. The meat used was fresh beef mince with 5% fat content. Figure 5 highlights the complete reduction in microbial counts of the microflora and pathogens present in the meat after 72 hours at dilutions of 1x10 -1 CFU/mL and 1x10 -4 CFU/mL when treated with 5 times the MIC identified in standard conditions. This study suggests the compound could be a suitable natural ingredient for extending the shelf life and control pathogenic populations in fresh minced meat.

EXAMPLE 2

The following peptides were tested for bacterial inhibition activity in solid and liquid media test. I_87_SF [SEQ ID 32] is an antibacterial fragment of Rice Protein P14614, whereas the remaining six peptides are comparative peptides.

I_45_SF	ITSVNSQKFPILNLIQMSATR
I_77_SF	SRVQVVSNFGK
E_31_SF	VLDLAIPVNKPGQLQSFLLSGTQNQPSLLSGFSK
E_376_SF	NAMFVPHYNLNANSIIYALKGR
E_78_SF	LRPGVMFVVPAGHPFVNIASK
E_354_SF	GLFDLGHPLVNR
I_87_SF	LNSQKFPILNLVQLSATR [SEQ ID 32]

UCD_CFS_Strains used for Determination of antibacterial activity

	Strain	Type	Hospital/Isolation	Source	ARP (Resistant to)	Reference
Gram-negative	*E. coli* 25922	Reference	FDA strain Seattle 1946 [DSM 1103, NCIB 12210]	-	PEN; VAN; AMP; CLI; CL	http://www.atcc.org/ATCCAdvancedCatalogSearch/ProductDetails/tabid/452/Default.aspx?ATCCNum=25922&Template=bacteria
	Acinetobacter baumannii ATCC19606	Reference	Deposit in ATCC as *Bacterium anitratum* Schaub and Hauber 2208 [81, DSM 6974]	Urine	-	Hugh R, Reese R. Designation of the type strain for Bacterium anitratum Schaub and Hauber 1948. Int. J. Syst. Bacteriol. 17: 245-254, 1967.
Gram-positive	MRSA ATCC 43300	Reference	Kansas	Human	AMP; PEN; OXA; MET; AXO; CIP; LEVO; GAT; ERY; CLI	http://www.atcc.org/ATCCAdvancedCatalogSearch/ProductDetails/tabid/452/Default.aspx?ATCCNum=43300&Template=bacteria

Abbreviations: MRSA – Methicillin-Resistant *Staphylococcus aureus*; ARP – Antibiotic Resistance Profile; AMC - Amoxicillin-Clavulanic acid; C-Chloramphenicol; F- Furazolidone; Fc- Florfenicol Gm-Gentamycin; N-Neomycin; NAL-Nalidixic acid; S-Streptomycin; Su-Sulfonamides; TET-Tetracycline; TMP-Trimetoprim; AMP-ampicillin; PEN – penicillin; OXA – oxacillin; MET-methicillin; AXO – ceftriaxone; CIP-ciprofloxacin; LEVO-levofloxacin; GAT – gatifloxacin; ERY-erythromycin; CLI- clindamycin; CL- Cephalexin

Compounds tested. A total of 1 compound (1 peptide) was tested. Peptide stock=5mg/mL dissolved in DMSO.

Preparation of the peptide. The powder was reconstituted with 1.04 mL of DMSO to achieve a final concentration of 5mg/mL. The peptide was in high purity. No precipitation problems.

Antibacterial activity testing (in solid media). Bacterial inoculums were adjusted to McFarland 0.5 standard and MHA plates swabbed. Blank disks were placed in the plates and 10 µL of each compound (at 64 µg/mL – maximum concentration tested) added. Plates were incubated at 37°C for 16-18 hours. Appropriate controls (DMSO; Mueller-Hinton media alone; and two antibiotic discs – ciprofloxacin and tetracycline) were also performed.

Results from the testing in agar-plates

Determination of antibacterial activity (inhibition of growth) was performed in Mueller-Hinton plates. After incubation period results were registered and plates photographed.

Compounds	**Inhibition zone diameter (mm)**								
ID	***E. coli* ATCC 25922**			***A. baumannii* ATCC 19606**			**MRSA ATCC 43300**		
	Rep 1	**Rep 2**	**Rep 3**	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 1**	**Rep 2**	**Rep 3**
I_87_SF	10	10	9	NI	NI	NI	18	18	18
TET	**28**	**26**	**26**	**23**	**24**	**24**	**31**	**31**	**32**
CIP	**42**	**40**	**42**	**27**	**28**	**27**	**27**	**28**	**29**
DMSO	NI	NI	NI	NI	NI	NI	NI	NI	NI
MH	NI	NI	NI	NI	NI	NI	NI	NI	NI

Legend: TET – tetracycline; CIP – Ciprofloxacin; MH – Mueller-Hinton (control); NI – No Inhibition of growth

Final result: Peptide I_87_SF showed some inhibitory activity against *E. coli* and MRSA, but not at the levels of susceptibility. No activity was obtained against *A. baumannii*.

Results from the testing in agar-plates (photos)

Note: Only one set is shown since the other two sets had the same results. Control antibiotic discs (TET and CIP) were placed in the centre of each plate.

The invention is not limited to the embodiments hereinbefore described which may be varied in construction and detail without departing from the spirit of the invention.

SEQUENCES

PROTEIN : P13918 - 2 – Pea

MAATTMKASFPLLMLMGISFLASVCVSSRSDPQNPFIFKSNKFQTLFENENGHIRLLQKFDQRSKIFENLQNYRLLEYKSKPHTIFLPQHTDADYI
LVVLSGKAILTVLKPDDRNSFNLERGDTIKLPAGTIAYLVNRDDNEELRVLDLAIPVNRPGQLQSFLLSGNQNQQNYLSGFSKNILEASFNTDYEE
IEKVLLEEHEKETQHRRSLKDKRQQSQEENVIVKLSRGQIEELSKNAKSTSKKSVSSESEPFNLRSRGPIYSNEFGKFFEITPEKNPQLQDLDIFVNS
VEIKEGSLLLPHYNSRAIVIVTVNEGKGDFELVGQRNENQQEQRKEDDEEEEQGEEEINKQVQNYKAKLSSGDVFVIPAGHPVAVKASSNLDLL
GFGINAENNQRNFLAGDEDNVISQIQRPVKELAFPGSAQEVDRILENQKQSHFADAQPQQRERGSRETRDRLSSV [SEQ ID 1]

PEPTIDE : GSLLLPHYN [SEQ ID 7]
PEPTIDE : GSLLLPHYNS [SEQ ID 8]
PEPTIDE : SSNLDLLGFG [SEQ ID 9]

PROTEIN : Q9M3X6 - 3 – Pea

MATTIKSRFPLLLLLGIIFLASVVCVTYANYDEGSEPRVPAQRERGRQEGEKEEKRHGEWRPSYEKEEDEEEGQRERGRQEGEKEEKRHGEWR
PSYEKQEDEEEKQKYRYQREKEDEEEKQKYQYQREKKEQKEVQPGRERWEREEDEEQVDEEWRGSQRREDPEERARLRHREERTKRDRRHQ
REGEEEERSSESQERRNPFLFKSNKFLTLFENENGHIRLLQRFDKRSDLFENLQNYRLVEYRAKPHTIFLPQHIDADLILVVLSGKAILTVLSPNDR
NSYNLERGDTIKLPAGTTSYLVNQDDEEDLRLVDLVIPVNGPGKFEAFDLAKNKNQYLRGFSKNILEASYNTRYETIEKVLLEEQEKDRKRRQQG
EETDAIVKVSREQIEELKKLAKSSSKKSLPSEFEPINLRSHKPEYSNKFGKLFEITPEKKYPQLQDLDLFVSCVEINEGALMLPHYNSRAIVVLLVNEG
KGNLELLGLKNEQQEREDRKERNNEVQRYEARLSPGDVVIIPAGHPVAITASSNLNLLGFGINAENNERNFLSGSDDNVISQIENPVKELTFPGS
VQEINRLIKNQKQSHFANAEPEQKEQGSQGKRSPLSSILGTFY [SEQ ID 2]

PEPTIDE : ELLGLKNE [SEQ ID 10]
PEPTIDE : SNLNLLGFG [SEQ ID 11]
PEPTIDE : ASSNLNLL [SEQ ID 12]
PEPTIDE : YPQLQDLDL [SEQ ID 13]
PEPTIDE : SSNLNLLGFG [SEQ ID 14]
PEPTIDE : ASSNLNLLG [SEQ ID 15]
PEPTIDE : LLGLKNEQQE [SEQ ID 16]
PEPTIDE : LVVLSGKAIL [SEQ ID 17]
PEPTIDE : LNLLGFGI [SEQ ID 18]
PEPTIDE : ASSNLNLLGF [SEQ ID 19]

PROTEIN : D3VNE2 - 5 – Pea

MAATPIKPLMLLAIAFLASVCVSSRSDQENPFIFKSNRFQTLYENENGHIRLLQKFDKRSKIFENLQNYRLLEYKSKPHTLFLPQYTDADFILVVLN
GKATLTVLKSNDRNSFNLERGDTIKLPAGTIAYLANRDDNEDLRVLDLAIPVNKPGQLQSFLLSGTQNQPSLLSGFSKNILEAAFNTNYEEIEKVL
LEQQEQEPQHRRSLKDRRQEINEENVIVKVSREQIEELSKNAKSSSKKSVSSESGPFNLRSRNPIYSNKFGKFFEITPEKNQQLQDLDIFVNSVDIK
EGSLLLPNYNSRAIVIVTVTEGKGDFELVGQRNENQGKENDKEEEQEEETSKQVQLYKAKLSPGDVFVIPAGHPVAINASSDLNLIGFGINAEN
NERNFLAGEEDNVISQVQRPVKELAFPGSSHEIDRLLKNQKQSYFANAQPLQRE [SEQ ID 3]

PEPTIDE : LQNYRLLE [SEQ ID 20]
PEPTIDE : LLSGTQNQPSLL [SEQ ID 21]
PEPTIDE : LLLPNYNSR [SEQ ID 22]
PEPTIDE : NLQNYRLLE [SEQ ID 23]
PEPTIDE : GSLLLPNYNS [SEQ ID 24]
PEPTIDE : NLQNYRLL [SEQ ID 25]

PROTEIN : P14323 - 2 – Rice

MASSVFSRFSIYFCVLLLCHGSMAQLFNPSTNPWHSPRQGSFRECRFDRLQAFEPLRKVRSEAGVTEYFDEKNELFQCTGTFVIRRVIQPQGLL
VPRYTNIPGVVYIIQGRGSMGLTFPGCPATYQQQFQQFSSQGQSQSQKFRDEHQKIHQFRQGDIVALPAGVAHWFYNDGDAPIVAVYVYDV
NNNANQLEPRQKEFLLAGNNNRAQQQQVYGSSIEQHSGQNIFSGFGVEMLSEALGINAVAAKRLQSQNDQRGEIIHVKNGLQLLKPTLTQQ
QEQAQAQDQYQQVQYSERQQTSSRWNGLEENFCTIKVRVNIENPSRADSYNPRAGRITSVNSQKFPILNLIQMSATRVNLYQNAILSPFWNV
NAHSLVYMIQGRSRVQVVSNFGKTVFDGVLRPGQLLIIPQHYAVLKKAEREGCQYIAIKTNANAFVSHLAGKNSVFRALPVDVVANAYRISRE
QARSLKNNRGEEHGAFTPRFQQQYYPGLSNESESETSE [SEQ ID 4]

PEPTIDE : NGLQLLKPTL [SEQ ID 26]
PEPTIDE : GLQLLKPTL [SEQ ID 27]
PEPTIDE : GVLRPGQLL [SEQ ID 28]
PEPTIDE : DGVLRPGQLL [SEQ ID 29]
PEPTIDE : LQLLKPTLTQQQE [SEQ ID 30]

PROTEIN : P14614 - 4 – Rice

MATIAFSRLSIYFCVLLLCHGSMAQLFGPNVNPWHNPRQGGFRECRFDRLQAFEPLRRVRSEAGVTEYFDEKNEQFQCTGTFVIRRVIEPQGL
LVPRYSNTPGMVYIIQGRGSMGLTFPGCPATYQQQFQQFLPEGQSQSQKFRDEHQKIHQFRQGDIVALPAGVAHWFYNEGDAPVVALYVF
DLNNNANQLEPRQKEFLLAGNNNREQQMYGRSIEQHSGQNIFSGFNNELLSEALGVNALVAKRLQGQNDQRGEIIRVKNGLKLLRPAFAQQ
QEQAQQQEQAQAQYQVQYSEEQQPSTRCNGLDENFCTIKARLNIENPSHADTYNPRAGRITRLNSQKFPILNLVQLSATRVNLYQNAILSPF
WNVNAHSLVYIVQGHARVQVVSNLGKTVFNGVLRPGQLLIIPQHYVVLKKAEHEGCQYISFKTNANSMVSHLAGKNSIFRAMPVDVIANAYR
ISREQARSLKNNRGEELGAFTPRYQQQTYPGFSNESENEALE [SEQ ID 5]

PEPTIDE : LSEALGVNAL [SEQ ID 31]
PEPTIDE : **LNSQKFPILNLVQLSATR** [SEQ ID 32]

PROTEIN : P07728 - 2 – Rice

MASINRPIVFFTVCLFLLCNGSLAQQLLGQSTSQWQSSRRGSPRECRFDRLQAFEPIRSVRSQAGTTEFFDVSNEQFQCTGVSVVRRVIEPRGL
LLPHYTNGASLVYIIQGRGITGPTFPGCPESYQQQFQQSGQAQLTESQSQSQKFKDEHQKIHRFRQGDVIALPAGVAHWCYNDGEVPVVAIY
VTDLNNGANQLDPRQRDFLLAGNKRNPQAYRREVEERSQNIFSGFSTELLSEALGVSSQVARQLQCQNDQRGEIVRVEHGLSLLQPYASLQE
QEQGQVQSRERYQEGQYQQSQYGSGCSNGLDETFCTLRVRQNIDNPNRADTYNPRAGRVTNLNTQNFPILSLVQMSAVKVNLYQNALLSP
FWNINAHSVVYITQGRARVQVVNNNGKTVFNGELRRGQLLIIPQHYAVVKKAQREGCAYIAFKTNPNSMVSHIAGKSSIFRALPNDVLANAY
RISREEAQRLKHNRGDEFGAFTPIQYKSYQDVYNAAESS [SEQ ID 6]

PEPTIDE : HGLSLLQPYA [SEQ ID 33]
PEPTIDE : HGLSLLQPYASL [SEQ ID 34]
PEPTIDE : HGLSLLQPY [SEQ ID 35]

ADDITIONAL PEPTIDES

DKIILGPK [SEQ ID 54]	P08688
DRKRRQQGEETDAIVK [SEQ ID 55]	Q9M3X6
IGINGFGRIGRLVAR [SEQ ID 56]	P34922
ILNRGHKIKGTVVL [SEQ ID 57]	P09918
INGFGRIGRLVAR [SEQ ID 58]	P34922
KKNEPWWPK [SEQ ID 59]	B5A8N6
LLLLGIIFLASVV [SEQ ID 60]	
RLLQKFDQRSKIF [SEQ ID 61]	
TIKSRFPLLLLLG [SEQ ID 62]	
TKAVKNTVGRAL [SEQ ID 63]	
VIVKLSR [SEQ ID 64]	P13918
GIARLAGTSSVIN [SEQ ID 65]	P15838

PROTEIN D3VNE2 [SEQ ID 66 to 73]
PEPTIDE : SGPFNLRSRNPIYSNKFGKFFE
PEPTIDE : TSKQVQLYKAKLSPGDVFVIPAG
PEPTIDE : GHIRLLQKFDKRSKIFE
PEPTIDE : TSKQVQLYKAKLSPGDVFVIPAGHP
PEPTIDE : TSKQVQLYKAKLSPGDVFVIPAGHPV
PEPTIDE : TSKQVQLYKAKLSPGDVFVIPAGHPVA
PEPTIDE : TSKQVQLYKAKLSPGDVFVIPAGHPVAI
PEPTIDE : TSKQVQLYKAKLSPGDVFVIPAGHPVAIN

PROTEIN P07728 [SEQ ID 74-80]
PEPTIDE : KFKDEHQKIHRFRQGDVIALPAGVAHW

PEPTIDE : KFKDEHQKIHRFRQGDVIALPAGVAHWC
PEPTIDE : KFKDEHQKIHRFRQGDVIALPAGVAHWCY
PEPTIDE : SPFWNINAHSVVYITQGRARVQVVNNNGK
PEPTIDE : QKIHRFRQGDVIALPAGVAHW
PEPTIDE : VVRRVIEPRGLLLPHYTNG
PEPTIDE : VRRVIEPRGLLLPHYTNG

PROTEIN P13918 [SEQ ID 81]
PEPTIDE : IRLLQKFDQRSKIFE

PROTEIN P14323 [SEQ ID 82-98]
PEPTIDE : AVAAKRLQSQNDQRGEIIHVKNGLQ
PEPTIDE : VAAKRLQSQNDQRGEIIHVKNGLQ
PEPTIDE : TVFDGVLRPGQLLIIPQHYAVLKK
PEPTIDE : PSTNPWHSPR
PEPTIDE : NPSTNPWHSPRQGSFR
PEPTIDE : QLFNPSTNPWHSPRQGSFR
PEPTIDE : SMAQLFNPSTNPWHSPRQGSFR
PEPTIDE : QLFNPSTNPWHSPRQGSFRECRF
PEPTIDE : CHGSMAQLFNPSTNPWHSPRQGSFR
PEPTIDE : CHGSMAQLFNPSTNPWHSPRQGSFRECRF
PEPTIDE : LLLCHGSMAQLFNPSTNPWHSPRQGSFR
PEPTIDE : PSTNPWHSPRQGSFRE
PEPTIDE : PWHSPRQGSFRE
PEPTIDE : QLFNPSTNPWHSPRQGSF
PEPTIDE : RVIQPQGLLVPR
PEPTIDE : FNPSTNPWHSPRQGSF
PEPTIDE : FNPSTNPWHSPRQGS

PROTEIN P14614 [SEQ ID 99-105]
PEPTIDE : GPNVNPWHNPRQGGFRECR
PEPTIDE : QLFGPNVNPWHNPRQGGFR
PEPTIDE : QLFGPNVNPWHNPRQGGFRECR
PEPTIDE : SMAQLFGPNVNPWHNPRQGGFR
PEPTIDE : CHGSMAQLFGPNVNPWHNPRQGGFR
PEPTIDE : SMAQLFGPNVNPWHNPRQGGFRECR
PEPTIDE : LLLCHGSMAQLFGPNVNPWHNPRQGGFR

PROTEIN Q9M3X6 [SEQ ID 106-251]
PEPTIDE : WRPSYEKEE
PEPTIDE : AKPHTIFLPQHIDADLILVVLSGKAILTVLSPNDR
PEPTIDE : PRVPAQRERGRQEGEKEEKRHGEWRP
PEPTIDE : PRVPAQRERGRQEGEKEEKRHGEWRPS
PEPTIDE : PRVPAQRERGRQEGEKEEKRHGEWRPSY
PEPTIDE : PRVPAQRERGRQEGEKEEKRHGEWR
PEPTIDE : GSEPRVPAQRERGRQEGEKEEKRHGEWRP [112]
PEPTIDE : KRHGEWRPSYEK
PEPTIDE : KKEQKEVQPGRERW
PEPTIDE : KKEQKEVQPGRERWER
PEPTIDE : REKKEQKEVQPGRERW
PEPTIDE : QREKKEQKEVQPGRERW
PEPTIDE : REKKEQKEVQPGRERWER
PEPTIDE : QREKKEQKEVQPGRERWER
PEPTIDE : QYQREKKEQKEVQPGRERW [120]
PEPTIDE : YQYQREKKEQKEVQPGRERW
PEPTIDE : QYQREKKEQKEVQPGRERWER
PEPTIDE : QKYQYQREKKEQKEVQPGRERW
PEPTIDE : YQYQREKKEQKEVQPGRERWER
PEPTIDE : KQKYQYQREKKEQKEVQPGRERW
PEPTIDE : QKYQYQREKKEQKEVQPGRERWE
PEPTIDE : KQKYQYQREKKEQKEVQPGRERWE
PEPTIDE : QKYQYQREKKEQKEVQPGRERWER
PEPTIDE : EEKQKYQYQREKKEQKEVQPGRERW

PEPTIDE : KQKYQYQREKKEQKEVQPGRERWER [130]
PEPTIDE : QKYQYQREKKEQKEVQPGRERWERE
PEPTIDE : KQKYQYQREKKEQKEVQPGRERWERE
PEPTIDE : EEKQKYQYQREKKEQKEVQPGRERWER
PEPTIDE : KQKYQYQREKKEQKEVQPGRERWEREE
PEPTIDE : PINLRSHKPEYSNKFGKLFEITPEKKYP
PEPTIDE : KRHGEWRPSY
PEPTIDE : PAQRERGRQEGEKEEKRHGEWRP
PEPTIDE : PAQRERGRQEGEKEEKRHGEWRPS
PEPTIDE : PRVPAQRERGRQEGEKEEKRHGEW
PEPTIDE : EWRGSQRREDPEERARLRHREERTK [140]
PEPTIDE : PAQRERGRQEGEKEEKRHGEWRPSY
PEPTIDE : EWRGSQRREDPEERARLRHREERTKR
PEPTIDE : PAQRERGRQEGEKEEKRHGEWRPSYE
PEPTIDE : EEWRGSQRREDPEERARLRHREERTKR
PEPTIDE : EWRGSQRREDPEERARLRHREERTKRD
PEPTIDE : GSEPRVPAQRERGRQEGEKEEKRHGEW
PEPTIDE : PAQRERGRQEGEKEEKRHGEWRPSYEK
PEPTIDE : EWRGSQRREDPEERARLRHREERTKRDR
PEPTIDE : GSEPRVPAQRERGRQEGEKEEKRHGEWR
PEPTIDE : PAQRERGRQEGEKEEKRHGEWRPSYEKE [150]
PEPTIDE : EEWRGSQRREDPEERARLRHREERTKRDR
PEPTIDE : EWRGSQRREDPEERARLRHREERTKRDRR
PEPTIDE : KEEKRHGEWRP
PEPTIDE : KEEKRHGEWRPS
PEPTIDE : GEKEEKRHGEWRP
PEPTIDE : KEEKRHGEWRPSY
PEPTIDE : KEQKEVQPGRERW
PEPTIDE : KRHGEWRPSYEKE
PEPTIDE : EEKRHGEWRPSYEK
PEPTIDE : GEKEEKRHGEWRPS [160]
PEPTIDE : KEEKRHGEWRPSYE
PEPTIDE : KEQKEVQPGRERWE
PEPTIDE : EEKRHGEWRPSYEKQ
PEPTIDE : GEKEEKRHGEWRPSY
PEPTIDE : KEEKRHGEWRPSYEK
PEPTIDE : KEQKEVQPGRERWER
PEPTIDE : KKEQKEVQPGRERWE
PEPTIDE : KEEKRHGEWRPSYEKE
PEPTIDE : KEQKEVQPGRERWERE
PEPTIDE : RQEGEKEEKRHGEWRP [170]
PEPTIDE : GEKEEKRHGEWRPSYEK
PEPTIDE : GRQEGEKEEKRHGEWRP
PEPTIDE : KKEQKEVQPGRERWERE
PEPTIDE : REKKEQKEVQPGRERWE
PEPTIDE : RQEGEKEEKRHGEWRPS
PEPTIDE : GEKEEKRHGEWRPSYEKQ
PEPTIDE : GRQEGEKEEKRHGEWRPS
PEPTIDE : KKEQKEVQPGRERWEREE
PEPTIDE : QREKKEQKEVQPGRERWE
PEPTIDE : RQEGEKEEKRHGEWRPSY [180]
PEPTIDE : ERGRQEGEKEEKRHGEWRP
PEPTIDE : GRQEGEKEEKRHGEWRPSY
PEPTIDE : REKKEQKEVQPGRERWERE
PEPTIDE : ERGRQEGEKEEKRHGEWRPS
PEPTIDE : QREKKEQKEVQPGRERWERE
PEPTIDE : QYQREKKEQKEVQPGRERWE
PEPTIDE : REKKEQKEVQPGRERWEREE
PEPTIDE : RERGRQEGEKEEKRHGEWRP
PEPTIDE : RQEGEKEEKRHGEWRPSYEK
PEPTIDE : ERGRQEGEKEEKRHGEWRPSY [190]
PEPTIDE : GRQEGEKEEKRHGEWRPSYEK
PEPTIDE : PAQRERGRQEGEKEEKRHGEW

PEPTIDE : QREKKEQKEVQPGRERWEREE
PEPTIDE : RERGRQEGEKEEKRHGEWRPS
PEPTIDE : RQEGEKEEKRHGEWRPSYEKQ
PEPTIDE : YQYQREKKEQKEVQPGRERWE
PEPTIDE : GQRERGRQEGEKEEKRHGEWRP
PEPTIDE : PAQRERGRQEGEKEEKRHGEWR
PEPTIDE : QYQREKKEQKEVQPGRERWERE
PEPTIDE : RERGRQEGEKEEKRHGEWRPSY [200]
PEPTIDE : ERGRQEGEKEEKRHGEWRPSYEK
PEPTIDE : GQRERGRQEGEKEEKRHGEWRPS
PEPTIDE : QYQREKKEQKEVQPGRERWEREE
PEPTIDE : RERGRQEGEKEEKRHGEWRPSYE
PEPTIDE : YQYQREKKEQKEVQPGRERWERE
PEPTIDE : ERGRQEGEKEEKRHGEWRPSYEKQ
PEPTIDE : GQRERGRQEGEKEEKRHGEWRPSY
PEPTIDE : RERGRQEGEKEEKRHGEWRPSYEK
PEPTIDE : YQYQREKKEQKEVQPGRERWEREE
PEPTIDE : GQRERGRQEGEKEEKRHGEWRPSYE [210]
PEPTIDE : RERGRQEGEKEEKRHGEWRPSYEKE
PEPTIDE : RHGEWRPSYEKQEDEEEKQKYRYQR
PEPTIDE : EEEKQKYQYQREKKEQKEVQPGRERW
PEPTIDE : GQRERGRQEGEKEEKRHGEWRPSYEK
PEPTIDE : QKYQYQREKKEQKEVQPGRERWEREE
PEPTIDE : EEEKQKYQYQREKKEQKEVQPGRERWE
PEPTIDE : GQRERGRQEGEKEEKRHGEWRPSYEKQ
PEPTIDE : QKYQYQREKKEQKEVQPGRERWEREED
PEPTIDE : RHGEWRPSYEKQEDEEEKQKYRYQREK
PEPTIDE : EEEKQKYQYQREKKEQKEVQPGRERWER [220]
PEPTIDE : EEKQKYQYQREKKEQKEVQPGRERWERE
PEPTIDE : GQRERGRQEGEKEEKRHGEWRPSYEKQE
PEPTIDE : KQKYQYQREKKEQKEVQPGRERWEREED
PEPTIDE : PSEFEPINLRSHKPEYSNKFGKLFEITP
PEPTIDE : EEEKQKYQYQREKKEQKEVQPGRERWERE
PEPTIDE : KEDEEEKQKYQYQREKKEQKEVQPGRERW
PEPTIDE : KQKYQYQREKKEQKEVQPGRERWEREEDE
PEPTIDE : LPSEFEPINLRSHKPEYSNKFGKLFEITP
PEPTIDE : EEKRHGEWRP
PEPTIDE : KEVQPGRERW [230]
PEPTIDE : QKEVQPGRERW
PEPTIDE : EEKRHGEWRPSY
PEPTIDE : RHGEWRPSYEKQ
PEPTIDE : KEVQPGRERWERE
PEPTIDE : RHGEWRPSYEKQE
PEPTIDE : QKEVQPGRERWERE
PEPTIDE : KKSLPSEFEPINLRSHKP
PEPTIDE : EWRGSQRREDPEERARLRHR
PEPTIDE : SSKKSLPSEFEPINLRSHKP
PEPTIDE : KPEYSNKFGKLFEITPEKKYP [240]
PEPTIDE : SSSKKSLPSEFEPINLRSHKP
PEPTIDE : HKPEYSNKFGKLFEITPEKKYP
PEPTIDE : AKSSSKKSLPSEFEPINLRSHKP
PEPTIDE : INLRSHKPEYSNKFGKLFEITPEKKYP
PEPTIDE : AKSSSKKSLPSEFEPINLRSHKPEYSNKF
PEPTIDE : RRNPFLFKSNKFLTLFE
PEPTIDE : PINLRSHKPEYSNKFGKLFEITPEKKYPQ
PEPTIDE : KPEYSNKFGKLFEITPEKKYPQLQ
PEPTIDE : HKPEYSNKFGKLFEITPEKKYPQLQ
PEPTIDE : SHKPEYSNKFGKLFEITPEKKYPQLQ [250]
PEPTIDE : FEPINLRSHKPEYSNKFGKLFEITPEKK

Examples of homologs for each protein

P13918 (Pea)

>gi|137584|sp|P08438.1|VCL_VICFA RecName: Full=Vicilin; Flags: Precursor [Vicia faba] >gi|22057|emb|CAA68559.1| vicilin [Vicia faba var. minor] >gi|383931031|gb|AFH56916.1| vicilin **[Vicia faba]**

MAATTLKDSFPLLTLLGIAFLASVCLSSRSDQDNPFVFESNRFQTLFENENGHIRLLQKFDQHSKLLENLQNYRLLEYKSKPHTIFLPQQTDADFIL
VVLSGKAILTVLLPNDRNSFSLERGDTIKLPAGTIGYLVNRDDEEDLRVLDLVIPVNRPGEPQSFLLSGNQNQPSILSGFSKNILEASFNTDYKEIEK
VLLEEHGKEKYHRRGLKDRRQRGQEENVIVKISRKQIEELNKNAKSSSKKSTSSESEPFNLRSREPIYSNKFGKFFEITPKRNPQLQDLNIFVNYVEI
NEGSLLLPHYNSRAIVIVTVNEGKGDFELVGQRNENQQGLREEYDEEKEQGEEEIRKQVQNYKAKLSPGDVLVIPAGYPVAIKASSNLNLVGFGI
NAENNQRYFLAGEEDNVISQIHKPVKELAFPGSAQEVDTLLENQKQSHFANAQPRERERGSQEIKDHLYSILGSF [SEQ ID 53]

>gi|502105533|ref|XP_004492829.1| PREDICTED: vicilin-like isoform X1 **[Cicer arietinum] ChickPea**

MAIKARFPLLVLLGIVFLASVCAKSDKENPFFFKSNNCQTLFENENGHVRLLQRFDKRSQLFENLQNYRLMEYNSKPHTLFLPQHNDADFILVVL
RGRAILTVLNPNDRNTFKLERGDTIKLPAGTIAYLANRDDNEDLRVLDLAIPVNRPGQFQSFSLSGNENQQSYFQGFSKKILEASFNSDYEEIERV
LLEEQEQKPEQRRGHKGRQQSQETDVIVKISREQIEELSKNAKSNCKKSVSSESEPFNLRSRSPIYSNRFGNFFEITPEKNPQLKDLDIFVNSVEIK
EGSLLLPHFNSRATVILVVNEGKGEVELVGLRNENEQENKKEDEEEEEDRNVQVQRFQSKLSSGDVVVIPASHPFSINASSDLFLLGFGINAQN
NQRNFLAGEEDNVISQIQRPVKEVAFPGSAEEVDRLLKNQRQSHFANAQPQQKRKGSQRIRSPF [SEQ ID 36]

>gi|29539109|emb|CAD87730.1| allergen Len c 1.0101 **[Lens culinaris] Lentil**

SRSDQENPFIFKSNRFQTIYENENGHIRLLQRFDKRSKIFENLQNYRLLEYKSKPHTIFLPQFTDADFILVVLSGKAILTVLNSNDRNSFNLERGDTI
KLPAGTIAYLANRDDNEDLRVLDLAIPVNRPGQLQSFLLSGTQNQPSFLSGFSKNILEAAFNTEYEEIEKVLLEEQEQKSQHRRSLRDKRQEITNE
DVIVKVSREQIEELSKNAKSSSKKSVSSESEPFNLRSRNPIYSNKFGKFFEITPEKNPQLQDLDIFVNSVEIKEGSLLLPNYNSRAIVIVTVNEGKGDF
ELVGQRNENQQEQREENDEEEGQEEETTKQVQRYRARLSPGDVLVIPAGHPVAINASSDLNLIGFGINAKNNQRNFLAGEEDNVISQIQRPV
KELAFPGSSREVDRLLTNQKQSHFANAQPLQIE [SEQ ID 37]

Q9M3X6 (Pea)

>gi|164512526|emb|CAP06312.1| cvc [Pisum abyssinicum]

MATTVESRFPLLLFPGIIFLASVCVTYANYDEGSETRVPGQRERGRQEGEKEEKRHGEWRPSYEKEEDEEEKQKYRYQREKEDEEEKQKYRYQR
EKKEEKEVQPGRERWEREEDEEQVDEEWRGSQRRQDPEERARLRHREERTKRDRRHKREGEEEERSSESQEQRNPFLFKSNKFLTLFENENG
HIRRLQRFDKRSDLFENLQNYRLVEYRAKPHTIFLPQHIDADLILVVLNGKAILTVLSPNDRNSYNLERGDTIKIPAGTTSYLVNQDDEEDLRVVD
FVIPVNRPGKFEAFGLSENKNQYLRGFSKNILEASLNTKYETIEKVLLEEQEKKPQQLRDRKRRQQGGERDAIIKVSREQIEELRKLAKSSSKKSLPS
EFEPFNLRSHKPEYSNKFGKLFEITPEKKYPQLQDLDILVSCVEINKGALMLPHYNSRAIVVLLVNEGKGNLELLGLKNEQQEREDRKERNNEVQ
RYEARLSPGDVVIIPAGHPVAISASSNLNLLGFGTNAENNQRNFLSGSDDN [SEQ ID 38]

>gi|164512538|emb|CAP06318.1| cvc [Lathyrus annuus]

MATTIKSRFPLLLLLGIIFLASVCVTWANYDEGSEPRVPGQRERGRQEGEKEEKRHGEWRPSYEEEYDEGLEPKVPGKRERGRQEGEKEEKRHE
EWRPSYEKEEDEEEKQKYNYQREKKEHKEVQPGRERWERKQDEKQVEEDEEPGEEQWRGSKRHEDPEERARLRHREEKTKSYVEDNEETSS
KEGRNPFLFKSNKFLTLFENENGHIRRLQRFDERSDIFENLQNYRLVEYRAKPHTMFLPQHIDADLILVVLNGKAILTVLSPNDRNSYNLERGDT
VKLPAGTTSYLVNQDDEEDLRVVDLAIPVNRPGKFEAFGLSANKNQYLRGFSKNILEASLNTKYETIEKVLLEERRDQKGRQQGQETNAIVKVSR
EQIEELRKLAKSSSKKSLLSESEPLNLRSQNPKYSNKFGKFFEITPQKKYPQLQDLDVSISCVEINKGALLLPHYNSRSIGILLVNEGKGNLELVGFKN
EQQRQRENEETNKKLQRYEARLSSGDVVVIPEGHPVAISASSNLNLLGFGINAANNQRNFLTGSDDN [SEQ ID 39]

>gi|164512558|emb|CAP06328.1| cvc [Vicia villosa]

MATTIKSRFPVLLLLGIIFLTSVCVTYANYDEGREPSVPGQRERGRQEGEKEEKRHGEWRPSEEDEEEKYKYEEGRVPGQRERGRQEGEKEEKR
HGKWRPSEEEDEEEKYRYEEGSEPRGPGQRETGRQEGEKEKQRPEREPSYEKEEDEEEKQKYQYHREKKEQREVRPGRERFERHEDEEQWRG
IQRHEDPEERARERYRAEIAKRQVEEEREERDIPHEREQRNPFLFKSNKFQTLFQNENGYIRRLQRFDKRSDLFENLQNYRLVEYRAKPHTIFLPQ
HIDADLIIVVLSGRAILTVLSPDDRNSYNLERGDTIKLPAGTTSYLVNQDDEEDLRVVDLAIPVNRPGKVESFLLSGNKNQYLRGFSKNILEASFNT
NYETIERVLLEEQDKESQQSIGQKRRSQRQETNALVKVSREQLEDLKRLAKSSSQEGLSSQFEPINLRSQNPKYSNKFGKVFEITPEKKYPQLQDL
DLFVSSVDIKEGALMLPHYNSRAIVVLLVNEGRGNLELVGLKNEQQEQREKEDEQQERNNQVQRYEARLSPGDVVIIPAGHPVAVRASSDLNL
LAFGINAENNQRNFLAGSDDN [SEQ ID 40]

D3VNE2 (Pea)

>gi|29539111|emb|CAD87731.1| allergen Len c 1.0102 [Lens culinaris]

SRSDQENPFIFKSNRFQTIYENENGHIRLLQKFDKRSKIFENLQNYRLLEYKSKPHTLFLPQYTDADFILVVLSGKAVLTVLNSNDRNSFNLERGDT
IKLPAGTIAYLANRDDNEDLRVLDLAIPVNNPGQLESFLLSGTQNQPSFLSGFNKSILEAAFNTDYEEIEKVLLEDQEQEPQHRRSLRDRRQEINK
ENVIVKVSREQIKELSKNAKSSSKKSVSSESEPFNLRSRNPIYSNKFGKFFEITPEKNPQLQDLDIFVNSVEIKEGSLLLPNYNSRAIVIVTVNEGKGY
FELVGQRNENQREENDDEEEQEEETSTQVQRYRAKLSPGDVFVVPAGHPVAINASSDLNLIGFGINAKNNQRNFLAGEEDNVISQIQRPVKEL
AFPGSSREVDRLLTNQKQSHFANAQPLQIE [SEQ ID 41]

>gi|1297072|emb|CAA96514.1| vicilin precursor [Vicia narbonensis]

MAAITMKVSFPLLMLLGISFLASVCVSSRSDQENPFIFKSNKFQTLFENDNGHIRLLQKFDERSKILENLQNYRLLEYKSKPRTIFLPQQTNADFIL
VVLSGKAILTVLKPDDRNSFNLERGDTIKLPAGTIAYLVNKDDNEDLRVLDLAIPVNGPDQLQSFLLSGSENQQSILSGFSKSVLEASFNTGYEEIE
KVLLEEREKETQHRRSLRDKRQHSQDEDVIVKLSRGQIEELSRNAKSSSKKSVSSESEPFNLRSRNPIYSNKFGKFFEITPEKNPQLQDLDVLVNSV
EIKEGSLLLPHYNSRAIVIVTVNDGKGDFEIVGQRNENRQGQRKEDDEEEEQGDENTNTQVQNYKAKLSRGDVFVIPAGHPVSIKASSNLDLLG
FGINAKNNQRNFLAGEEDNVISQIDRPVKELAFPGSAQEVDRLLENQKQSHFANAQPQQRERGSHETRDHLSSILDAF [SEQ ID 42]

>gi|357507721|ref|XP_003624149.1| Provicilin [Medicago truncatula] >gi|87162569|gb|ABD28364.1| Cupin, RmlC-type [Medicago truncatula] >gi|355499164|gb|AES80367.1| vicilin 47 kDa protein [Medicago truncatula]

MAIKAPFQLLMLLGIFFLASVCVSSRDDRHDQENPFFFNANHFQTLFENENGHIRLLQRFDKRSKIFENLQNYRLLEYHSKPHTLFLPQHNDAD
FILAVLSGKAILTVLNPDNRNSFNLERGDTIKLPAGSIAYLANRDDNEDLRVLDLAIPVNRPGKFQSFSLSGSQNQQSFFSGFSKNILEAAFNANY
EEIERVLIEEHEQEPQHRRGLRKDRRQQSQDSNVIVKVSREQIEELSRHAKSSSRRSGSSESAPFNLRSREPIYSNEFGNFFEITPEKNPQLKDLDIL
VNYAEIREGSLLLPHFNSRATVIVVVDEGKGEFELVGQRNENQQEQREEDEQQEEERSQQVQRYRARLSPGDVYVIPAGHPTVVSASSDLSLL
GFGINAENNERNFLAGEEDNVISQIERPVKEVAFPGSAQDVESLLKNQRQSYFANAQPQQREREEGRSQRQRELISSILGVF [SEQ ID 43]

P14323 (Rice)

>gi|573918992|ref|XP_006647120.1| PREDICTED: glutelin type-B 2-like [Oryza brachyantha]

MATTVFSRFSTYFCVLLLCHGSMAQLFNPSTNPWHNPRQGSSRECRFDRLQPFEPLRKVRSEAGVTEYFDEKNELFQCTGTFVIRRVIQPQGLL
VPRYTNAPGLVYIIQGRGSIGLTFPGCPATYQQQFQQFLPQEQSQSQKFRDEHQKIHQFRQGDIVALPAGVAHWFYNDGDAPVVAVYVYDV
KNSANQLEPRQREFLLGGNNMRAQQVYGSSAEQHSRQNIFSGFGVEILSEALGISTVTTKRLQSQNDQRGEIIHVKNGLQFLKPTLTQQQEQA
QAQYQEVQYSEQQQTSSRWNGLDENFCTIKARMNIENTSRADTYNPRAGRTTSLNSQKFPILNLVQMSATRVNLYQNAILSTFWNVNAHSL
VYTIQGRARVQVVSNFGKTVFDGELRPGQLLIIPQHYVVLKKAQREGFRYIAIKTNANAFVSQLVGKNSVFRSLPVDVIANVYRISREQARSLKN
NRGEEHGAFAPRSQQQSYPGFSNQSESETSE [SEQ ID 44]

>gi|573919041|ref|XP_006647142.1| PREDICTED: glutelin type-B 4-like [Oryza brachyantha]

MATTTFSRFSIYFCVLLLCHGSMAQLFSPTLNPWHSSRRGGSRDCRFDRLQAFEPLRRVRSEAGVTEYFDERNEQFQCTGTFVIRRVIEPQGLL
VPRYTNTPGVVYIMQGRGSMGLTFPGCPATYQQQFQQFLPEGQSQSQKFRDEHQKIHQFRQGDIVALPAGVAHWFYNEGDTPVVALYVFD
INNSANQLEPRQKDFLLAGNNNREQQVYGRSIEKHSGQNIFSGFNHELLSEALGISTLAAKRLQGQNDHRGEIIRVRNGLQLLKPTFTQQQEQ
AQSQYQVQYSEKQQESTRCNGLDENFCTINARLNIENPSRADTYNPRAGRITHLNNQKFPILNLVQMSATRVNLYQNAILSPYWNVNAHSLV
YMVQGHARVQVVSNLGKTVFNSVLRPGQLLIIPQHYVVLKKAEREGCQYIAFKTNANSIVSQLAGKNSILRAMPVDVVANAYRISREQARDLK
NNRGEELGAFTPKFEQQSYPGLSNESESEASE [SEQ ID 45]

>gi|109894635|gb|ABG47337.1| glutelin precursor [Zizania latifolia]

MNMATINGPTIFFTVCLFLLCHGSLAQLLGQSTSQWQSSHRGSSRQCRFDRLQAFEPVRSVRSQAGTTEFFDASNELFQCAGVSIVRRIIEPRG
LLLPQYTNGATIMYIIQGRGITGQTFPGCPESYQQQFQQSMQAQLTGSQSQSQKFKDEHQKINRFRQGDVIALPAGVAHWCYNDGEVPVVA
IYVIDINNAANQLDPRQRDFLLAGNMRSPQAYRREVENQSQNIFSGFSAELLSEALGISTGVARQLQCQNDQRGEIVRVEHGLSLLQPYASLQE
QEQKQEQPRERYQVTQHQQSQYGGGCSNGLDETFCAMRIWQNIDNPNLADTYNPRAGRVTNLNSQKFPILNLIQMSAVKVNLYQNALLSP
FWNINSHSVVYVTQGCARVQVVNNNGKTVFNGELRRGQLLIIPQHYVVVKKAQREGCAYIAFKTNPNSMVSHIVGKSSIFRALPTDVLANAY
RISREDAQRLKHNRGDELGAFTPLQYKSYQDVSSVAASS [SEQ ID 46]

P14614 (Rice)

>gi|115445309|ref|NP_001046434.1| Os02g0248800 [Oryza sativa Japonica Group] >gi|37993738|gb|AAR06952.1| glutelin type-B [Oryza sativa Japonica Group] >gi|47497729|dbj|BAD19794.1| glutelin type-B [Oryza sativa Japonica Group] >gi|113535965|dbj|BAF08348.1| Os02g0248800 [Oryza sativa Japonica Group] >gi|215768942|dbj|BAH01171.1| unnamed protein product [Oryza sativa Japonica Group] >gi|284431772|gb|ADB84627.1| glutelin [Oryza sativa Japonica Group]

MTISVFSRFSIYFCVLLLCNGSMAQLFDPATNQWQTHRQGSFRECRFERLQAFEPLQNVRSEAGVTEYFDETNELFQCTGTFVIRRVIQPQGLL
IPRYANTPGMVYIIQGRGSMGLTFPGCPATYQQQSQQFLFQGESQSQKFIDEHQKIHQFRQGDIVVLPTGVAHWFYNDGDTPVVALYVYDI
NNSANQLEPRHREFLLAGKNNRVQQVYGRSIQQHSGQNIFNGFSVEPLSEALNINTVTTKRLQSQNDQRGEIIHVKNGLQLLKPTLTQRQEQE
QAQYQEVQYSEKPQTSSRWNGLEENLCTIKTRLNIENPSRADSYDPRAGRITSLDSQKFPILNIIQMSATRVNLYQNAILTPFWNVNAHSLMYV
IRGRARVQVVSNFGKTVFDGVLRPEQLLIIPQNYVVLKKAQHEGCQYIAINTNANAFVSHLAGVDSVFHALPVDVIANAYCISREEARRLKNNR
GDEYGPFPPRLQQQIYPEFSNESKGETSE [SEQ ID 47]

>gi|428674402|gb|AFZ41188.1| glutelin, partial [Oryza sativa Japonica Group]

LLCHGSMAQIFSLGINPWQNPRQGGSRECRFDRLQAFEPLRKVRHEAGVTEYFDEKNEQFQCTGTLVIRRIIEPQGLLLPRYSNTPGLVYIIQGT
GVLGLTFPGCPATYQKQFRHFGLEGGSQRQGKKLRDENQKIHQFRQGDVVALPSGIPHWFYNEGDTPVVALFVFDVNNNANQLEPRQKEFL
LAGNNIEQQVSNPSINKHSGQNIFNGFNTKLLSEALGVNIEVTRRLQSQNDRRGDIIRVKNGLRLIKPTITQQQEQTQDQYQQIQYHREQRSTS
KYNGLDENFCAIRARLNIENPNHADTYNPRAGRITNLNSQKFSILNLVQMSATRVNLYQNAILSPFWNINAHSLVYTIQGRARVQVVSNHGKA
VFNGVLRPGQLLIIPQNYVVMKKAELEGFQFIAFKTNPNAMVNHIAGKNSVLRAMPVDVIANAYRISRQEARSLKNNRGEEIGAFTPRYQQQ
KIHQEYSNPNESETQ [SEQ ID 48]

>gi|226510|prf||1515394A seed storage globulin

MATTRFPSLLFYSCIFLLCNGSMAQLFGQSFTPWQSSRQGGLRGCRFDRLQAFEPLRQVRSQAGITEYFDEQNEQFRCAGVSVIRRVIEPQGLL
LPQYHNAPGLVYILQGRGFTGLTFPGCPATFQQQFQPFDQARFAQGQSKSQNLKDEHQRVHHIKQGDVVALPAGIVHWCYNDGDAPIVAV
YVFDVNNNANQLEPRQKEFLLAGNNKREQQFGQNIFSGFSVQLLSEALGISQQAAQKIQSQNDQRGEIIRVSQGLQFLKPFVSQQGPVEHQA
YQPIQSQQEQSTQYQVGQSPQYQEGQSTQYQSGQSWDQSFNGLEENFCSLEARQNIENPKRADTYNPRAGRITHLNSKNFPTLNLVQMSA
TRVNLYQNAILSPYWNINAHSVMHMIQGRARVQVVNNHGQTVFNDILRRGQLLIIPQHYVVLKKAEREGCQYISFKTTPNSMVSYIAGKTSIL
RALPVDVLANAYRISRQESQNLKNNRGEEFGAFTPKFAQTGSQSYQDEGESSSTEKASE [SEQ ID 49]

P07728 (Rice)
>gi|531874314|gb|AGT59174.1| glutelin, partial [Oryza sativa Indica Group]

CRFDRLQAFEPIRSVRSQAGTTEFFDVSNEQFQCTGVSAVRRVIEPRGLLLPHYTNGASLVYIIQGRGITGPTFPGCPESYQQQFQQSGQAQLT
ESQSQSHKFKDEHQKIHRFRQGDVIALPAGVAHWCYNDGEVPVVAIYVTDLNNGANQLDPRQRDFLLAGNKRNPQAYRREVEERSQNIFSG
FSTELLSEALGVSSQVARQLQCQNDQRGEIVRVEHGLSLLQPYASLQEQEQGQVQSRERYQEGQYQQSQYGSGCSNGLDETFCTMKVRQNI
DNPNRADTYNPRAGRVTNLNTQNFPILNLVQMSAVKVNLYQNALLSPFWNINAHSVVYITQGRARVQVVNNNGKTVFNGELRRGQLLIIPQ
HYAVVKKAQREGCAYIAFKTNPNSMVSHIAGKSSIFRALPNDVLANAYRISREEAQRLKHNRGDEFGAFTPIQYKSYQDVYNAAESS [SEQ ID
50]

>gi|109894635|gb|ABG47337.1| glutelin precursor [Zizania latifolia]

MNMATINGPTIFFTVCLFLLCHGSLAQLLGQSTSQWQSSHRGSSRQCRFDRLQAFEPVRSVRSQAGTTEFFDASNELFQCAGVSIVRRIIEPRG
LLLPQYTNGATIMYIIQGRGITGQTFPGCPESYQQQFQQSMQAQLTGSQSQSQKFKDEHQKINRFRQGDVIALPAGVAHWCYNDGEVPVVA
IYVIDINNAANQLDPRQRDFLLAGNMRSPQAYRREVENQSQNIFSGFSAELLSEALGISTGVARQLQCQNDQRGEIVRVEHGLSLLQPYASLQE
QEQKQEQPRERYQVTQHQQSQYGGGCSNGLDETFCAMRIWQNIDNPNLADTYNPRAGRVTNLNSQKFPILNLIQMSAVKVNLYQNALLSP
FWNINSHSVVYVTQGCARVQVVNNNGKTVFNGELRRGQLLIIPQHYVVVKKAQREGCAYIAFKTNPNSMVSHIVGKSSIFRALPTDVLANAY
RISREDAQRLKHNRGDELGAFTPLQYKSYQDVSSVAASS [SEQ ID 51]

>gi|472867|emb|CAA52764.1| 11S globulin [Avena sativa]

MATTSFPSMLFYFCIFLLFHGSMAQLFGQSSTPWQSSRQGGLRGCRFDRLQAFEPLRQVRSQAGITEYFDEQNEQFRCTGVSVIRRVIEPQGL
VLPQYHNAPALVYILQGRGFTGLTFPGCPATFQQQFQPFDQSQFAQGQRQSQTIKDEHQRVQRFKQGDVVALPAGIVHWCYNDGDAPIVA
IYVFDVNNNANQLEPRQKEFLLAGNNKREQQSGNNIFSGLSVQLLSEALGISQQAAQRIQSQNDQRGEIIRVSQGLQFLKPIVSQQVPGEQQV
YQPIQTQEGQATQYQVGQSTQYQVGKSTPYQGGQSSQYQAGQSWDQSFNGLEENFCSLEARKNIENPQHADTYNPRAGRITRLNSKNFPIL
NIVQMSATRVNLYQNAILSPFWNINAHSVIYMIQGHARVQVVNNNGQTVFNDILRRGQLLIVPQHFVVLKKAEREGCQYISFKTNPNSMVSH
IAGKSSILRALPIDVLANAYRISRQEARNLKNNRGEEFGAFTPKLTQKGFQSYQDIEEGSSSPVRASE [SEQ ID 52]

Claims

1. A natural antibacterial peptide of up to 50 amino acids and comprising an antibacterial fragment of a protein selected from SEQUENCE ID NO's: 2, or an antibacterial variant of the fragment, in which the antibacterial fragment is selected from SEQUENCE ID NO's: 106 to 251.

2. A composition comprising at least one antibacterial peptide of Claim 1.

7. A composition according to Claim 6, and including a peptide profile comprising substantially all of the antibacterial fragments of SEQUENCE ID NO's: 106-251.

10. A comestible product for human or animal consumption comprising a composition according to Claim 7.

11. A cleaning product comprising a composition according to Claim 7.

12. A plant biocide comprising a composition according to Claim 7.

13. Use of a composition according to Claim 7 as a preservative.

14. Use of a composition according to Claim 7 as a plant biocide.

15. A natural antibacterial peptide of Claim 1, or composition of Claim 2 or 3, **for use in** treating a disease or condition characterised by a pathogenic bacterial infection.

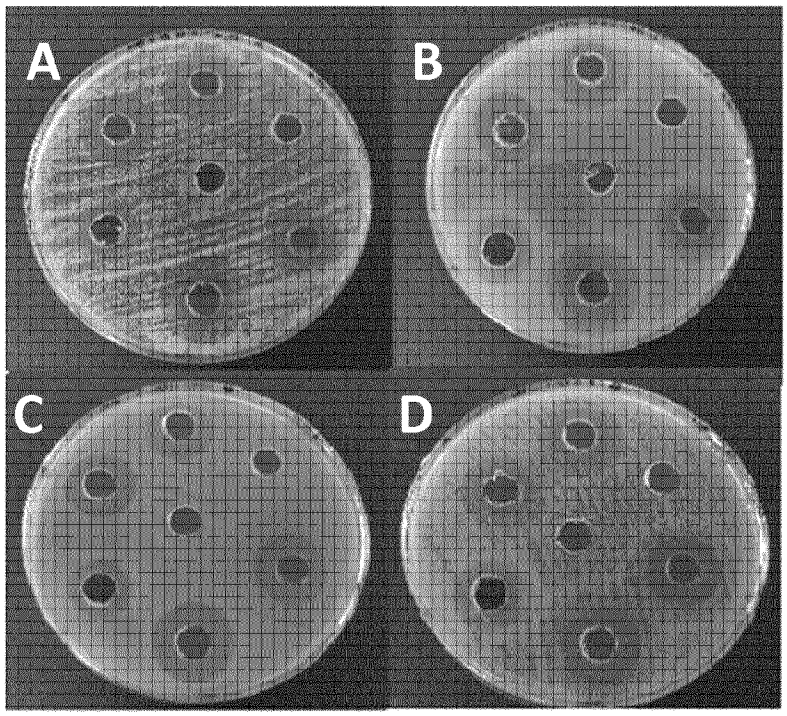


FIGURE 1

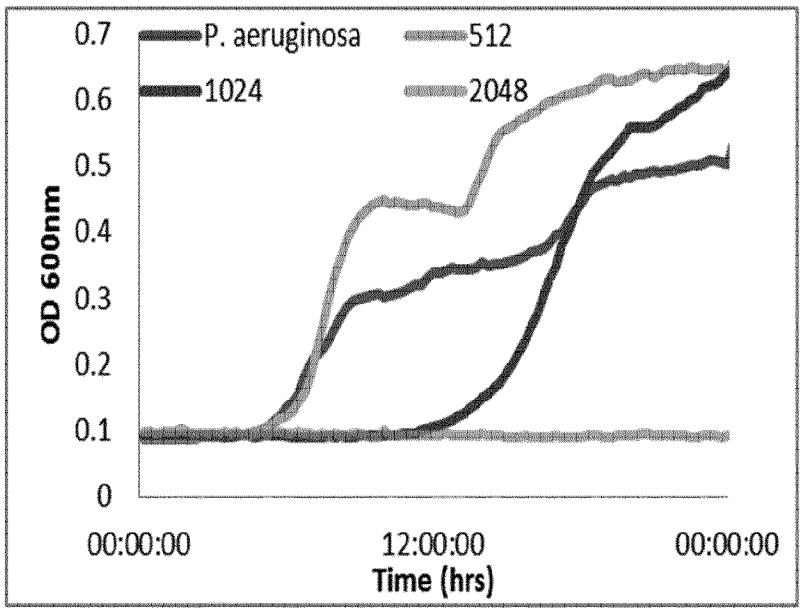


FIGURE 2

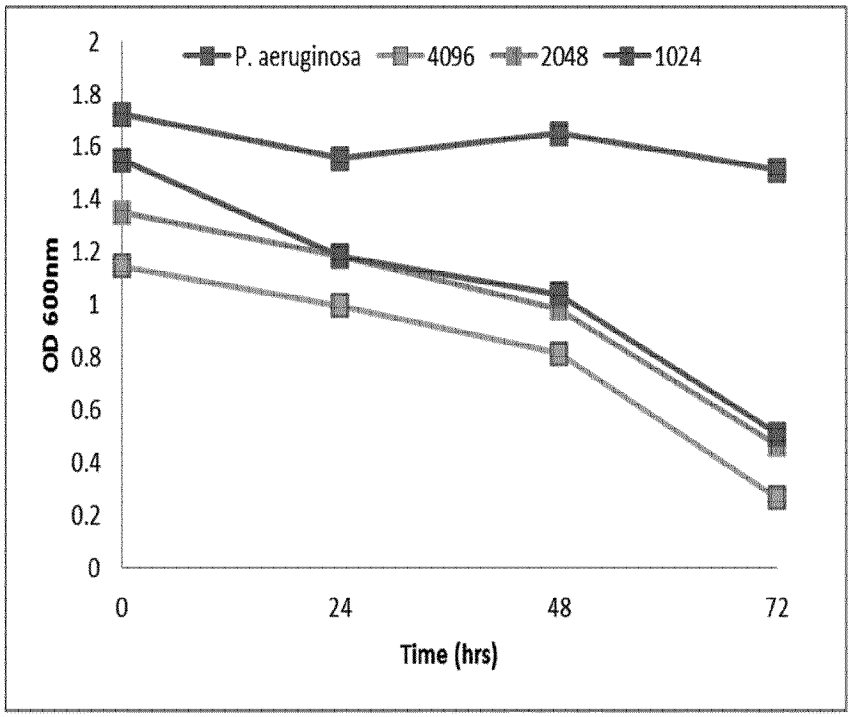
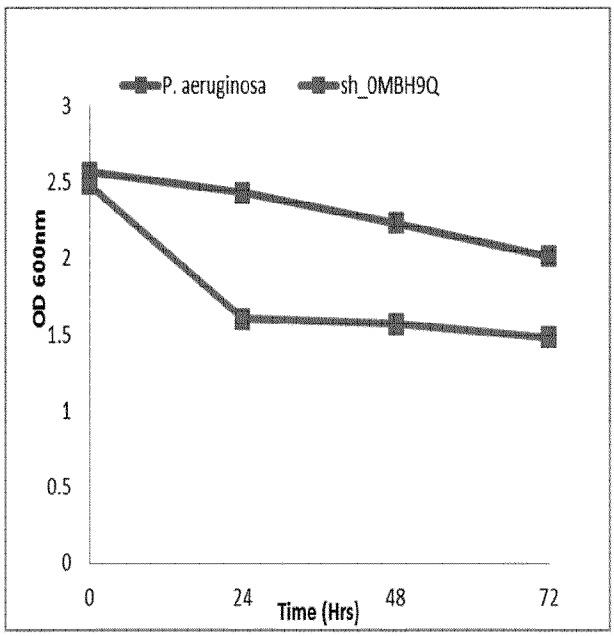


FIGURE 3



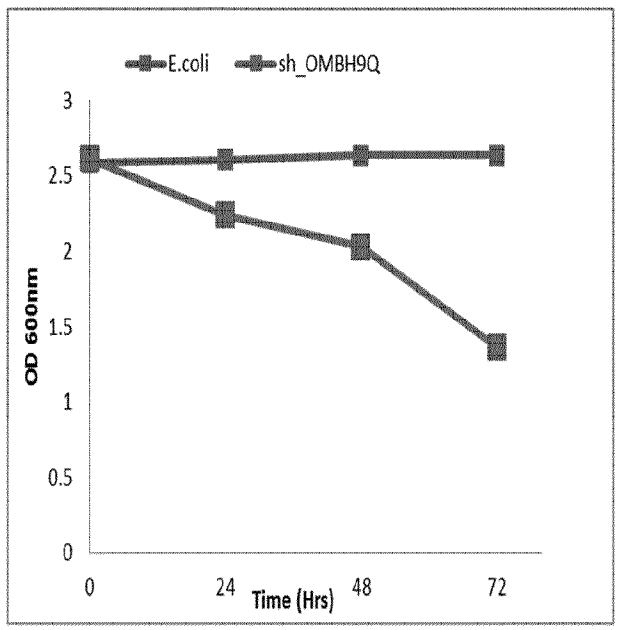


FIGURE 4

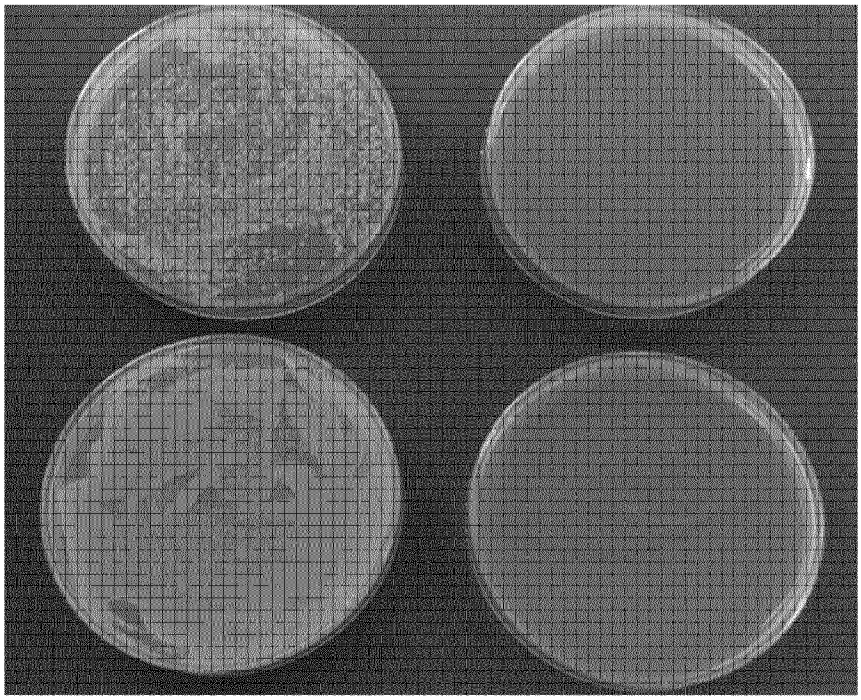


FIGURE 5

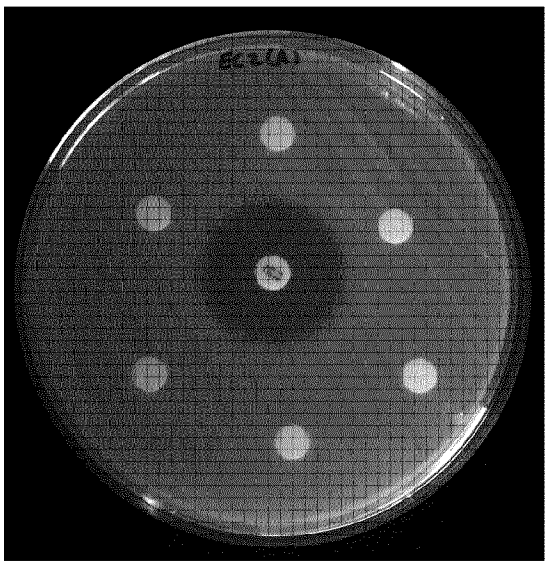


Figure 6A

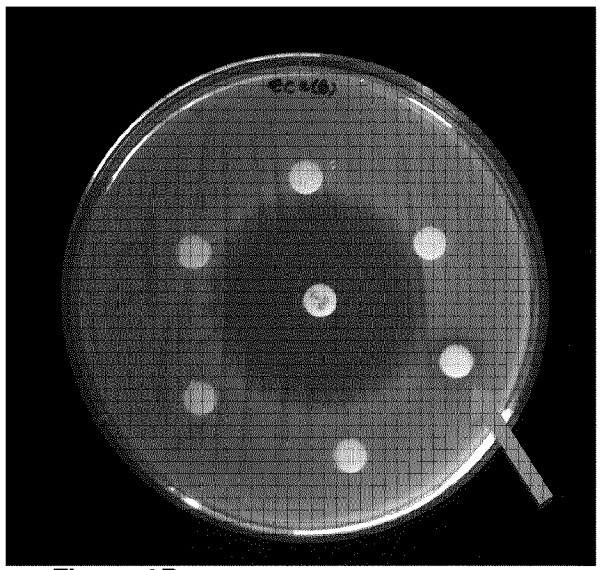


Figure 6B

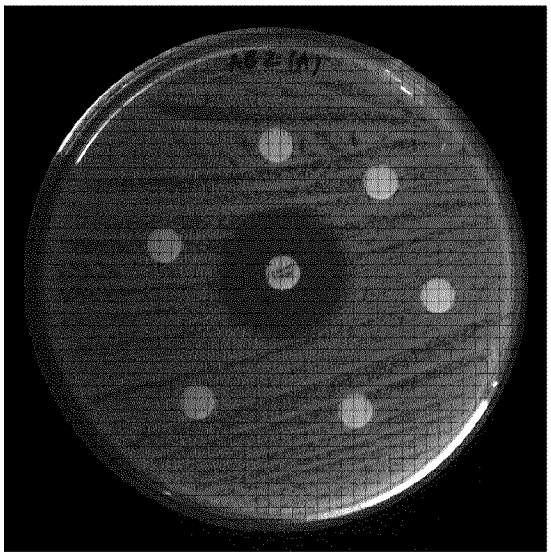


Figure 7A

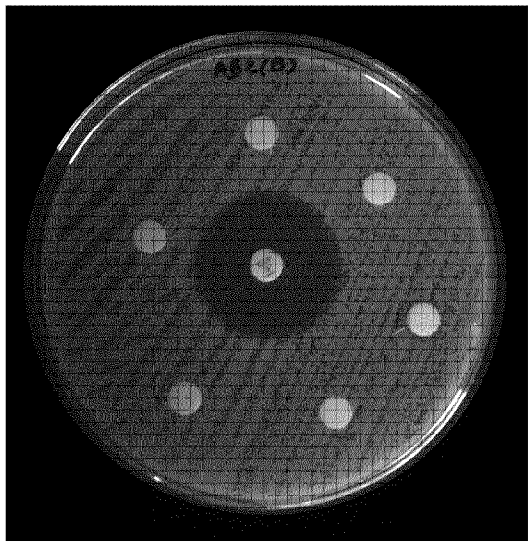


Figure 7B

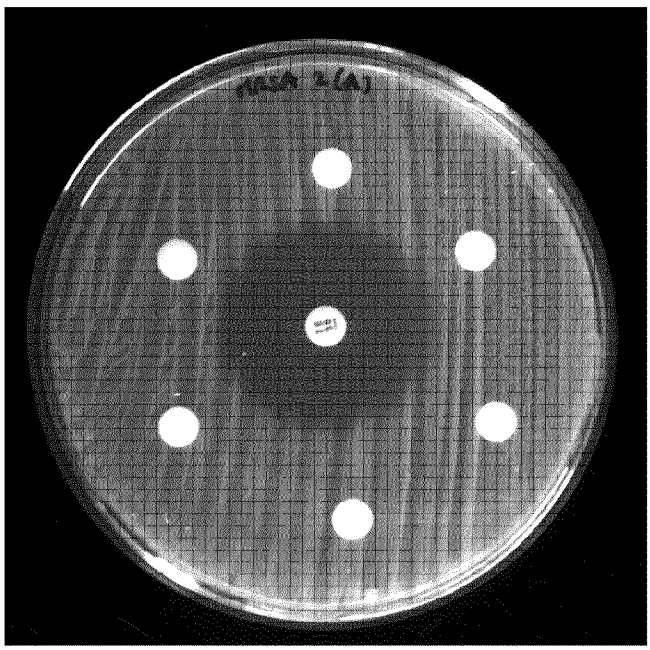


Figure 8A

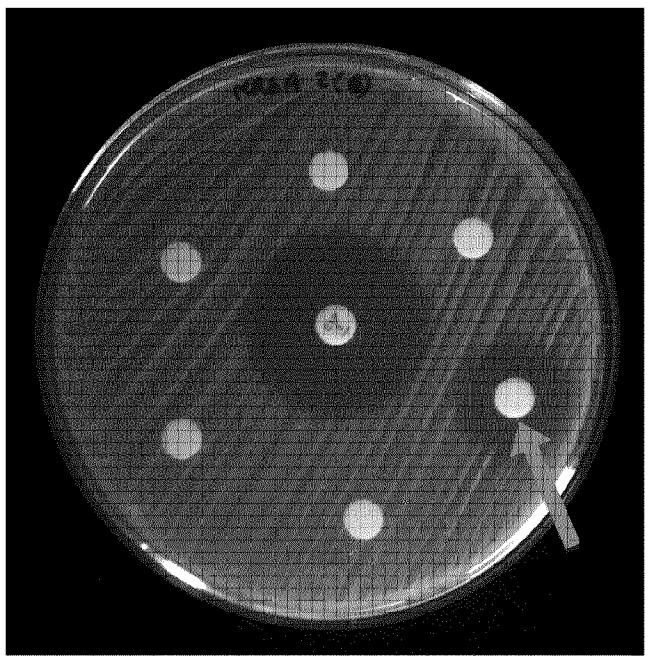


Figure 8B

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/067099

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K38/01 C07K14/415
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61K C07K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, Sequence Search, WPI Data, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2011/122944 A1 (NUTRICIA NV [NL]; GEORGI GILDA ELISE [DE]; EULER MARCO [DE]; MANK MARK) 6 October 2011 (2011-10-06) abstract sequence 5 page 18; table 1 -----	1,2,7, 10-15

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
7 November 2016	21/11/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Niebuhr-Ebel, K

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	MICHAEL NIEHUES ET AL: "Peptides from Pisum sativum L. enzymatic protein digest with anti-adhesive activity against Helicobacter pylori: Structure-activity and inhibitory activity against BabA, SabA, HpaA and a fibronectin-binding adhesin", MOLECULAR NUTRITION & FOOD RESEARCH, vol. 54, no. 12, 2 December 2010 (2010-12-02), pages 1851-1861, XP055237073, DE ISSN: 1613-4125, DOI: 10.1002/mnfr.201000021 abstract page 1856; table 1 page 1859, right-hand column, last paragraph - page 1860, left-hand column, paragraph 2 -----	1,2,7, 10-15
X	FATOU NDIAYE ET AL: "Anti-oxidant, anti-inflammatory and immunomodulating properties of an enzymatic protein hydrolysate from yellow field pea seeds", EUROPEAN JOURNAL OF NUTRITION, STEINKOPFF-VERLAG, DA, vol. 51, no. 1, 27 March 2011 (2011-03-27) , pages 29-37, XP035006350, ISSN: 1436-6215, DOI: 10.1007/S00394-011-0186-3 abstract page 29, right-hand column, last paragraph - page 30, left-hand column, paragraph 1 -----	1,2,7, 10-15
A	R. SANCHEZ-MONGE ET AL: "Vicilin and convicilin are potential major allergens from pea", CLINICAL & EXPERIMENTAL ALLERGY : JOURNAL OF THE BRITISH SOCIETY FOR ALLERGY AND CLINICAL IMMUNOLOGY, vol. 34, no. 11, 1 November 2004 (2004-11-01), pages 1747-1753, XP055316447, UK ISSN: 0954-7894, DOI: 10.1111/j.1365-2222.2004.02085.x abstract page 1752, left-hand column, paragraph 1 - paragraph 2 -----	1,2,7, 10-15

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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