CLAIMS

What we claim is:

1. An isolated apalbumin protein or fragment thereof, which has been chemically modified by methylglyoxal (MGO).

2. The protein of claim 1 being a modified apalbumin 1 (Apa1) protein or a fragment thereof.

3. The protein of claim 1 or claim 2 being isolated from manuka honey.

4. The protein of claim 2 or claim 3 having at least 17 amino acid residues modified by MGO.

5. The protein of any one of claims 2 to 4 having between 17 and 32 amino acid residues modified by MGO.

6. The protein of any one of claims 2 to 5 having about 32 amino acid residues modified by MGO.

7. The protein of any one of claims 2 to 6 wherein the amino acid residues that are modified are either lysine or arginine.

8. The protein of any one of claims 2 to 7 wherein the amino acid residues that are modified are lysine.

9. A composition comprising an isolated protein of any one of Claims 1 to 8.

10. An isolated MGO-modified apalbumin protein or fragment thereof that has anti-inflammatory capacity comprising at least 75% sequence identity an amino acid sequence to the amino acid sequence set forth in SEQ ID NO 1.

11. An isolated MGO-modified apalbumin protein or fragment thereof that has anti-inflammatory capacity comprising at least 85% sequence identity an amino acid sequence to the amino acid sequence set forth in SEQ ID NO 1.

12. An isolated MGO-modified apalbumin protein or fragment thereof that has anti-inflammatory capacity comprising at least 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% or 100% sequence identity an amino acid sequence to the amino acid sequence set forth in SEQ ID NO 1.

13. An isolated MGO-modified apalbumin protein or fragment thereof as claimed in any one of claims 10 to 12 being isolated from manuka honey.

14. A composition comprising the protein of any one of claims 10 to 12.

15. A method producing an anti-inflammatory molecule by modifying royal jelly, the method including the step of reacting royal jelly with at least 0.1% MGO.

16. The method of claim 15 including the step of reacting the royal jelly with at least 0.5% MGO

17. The method of claim 16 including the step of reacting royal jelly with at least 1.0% MGO

18. The method of any one of claims 15 to 17 wherein the method further includes the step of isolating the MGO modified apalbumin (MRJP1) protein from the royal jelly product.

19. A method of reducing inflammation in a cellular tissue, comprising the step of contacting the composition of Claim 8 or Claim 14 to the cellular tissue.

20. A method of reducing the rate of phagocytosis by immune system cells, comprising the step of administering the composition of Claim 8 or Claim 14 to immune system cells.

21. A method of inhibiting the receptors for phagocytosis on immune system cells, comprising the step of administering the composition of Claim 8 or Claim 14 to immune system cells.

22. A method of reducing the respiratory burst and release of reactive oxygen species in inflammatory cells, comprising the step of administering the composition of Claim 8 or Claim 14 to the inflammatory cells.

23. A method of identifying (i) the anti-inflammatory capacity or (ii) MGO-modified apalbumin concentration of a sample of honey, comprising the steps of:

a) assaying the fluorescence of the honey sample, and

b) correlating the measure of fluorescence of the honey sample with the anti-inflammatory capacity of the honey sample, by comparing the measure of fluorescence of a sample of honey and the anti-inflammatory capacity of one or more samples of honey with previously measured capacity to inhibit phagocytosis.

24. The method of claim 23 wherein the MGO-modified apalbumin is a modified apalbumin 1 protein (modified MRJP1).

25. The method of Claim 23, wherein the method is used to enable a bee keeper to determine the right time to harvest honey from a hive in order to obtain a honey sample containing a desired anti-inflammatory capacity or MGO-modified apalbumin content.

26. The method of Claim 23, wherein the method is used to enable a honey producer to determine a desired length of time to store honey, in order to obtain a honey sample with a desired anti-inflammatory capacity and MGO-modified apalbumin content.

27. A method of increasing the anti-inflammatory capacity of one or more apalbumin proteins, by chemically treating with MGO, formaldehyde, glyoxal and/or glutaraldehyde.

28. A method of increasing the anti-inflammatory capacity and MGO-modified apalbumin protein content of a sample of honey, comprising the step of adding MGO or a MGO-precursor molecule to a honey sample.

29. The method of claim 27 or claim 29 wherein the apalbumin protein is a modified apalbumin 1 protein.

CLAIMS

1. An isolated apalbumin 1 protein, which has been chemically modified by methylglyoxal (MGO), and which has anti-inflammatory capacity.

2. The isolated protein of claim 1 being isolated from manuka honey.

3. The isolated protein of claim 2 having:

a) at least 17 amino acid residues modified by MGO;

b) between 17 and 32 amino acid residues modified by MGO; or

c) about 32 amino acid residues modified by MGO.

4. The isolated protein of claim 2 or claim 3 wherein:

a) the amino acid residues that are modified are lysine;

b) the amino acid residues that are modified are arginine; or

c) the amino acid residues that are modified are lysine and arginine.

5. An isolated apalbumin protein or fragment thereof, which has been chemically modified by methylglyoxal (MGO), and which has anti-inflammatory capacity, wherein the protein or fragment thereof comprises:

at least 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% or 100% sequence identity to the amino acid sequence set forth in SEQ ID NO:1.

6. A composition comprising the protein of any one of claims 1 to 4, or the protein or fragment thereof of claim 5.

7. A method of producing an anti-inflammatory molecule by modifying royal jelly, the method including the step of reacting royal jelly with:

a) at least 0.1% MGO;

b) at least 0.5% MGO; or

c) at least 1.0% MGO; and

an optional step of isolating an MGO-modified apalbumin 1 protein, or an MGO-modified apalbumin protein or fragment thereof comprising at least 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% or 100% sequence identity to the amino acid sequence set forth in SEQ ID NO:1, from the royal jelly product.

8. The composition of claim 6 for use in

a) reducing inflammation in a cellular tissue;

b) reducing the rate of phagocytosis by immune system cells;

c) inhibiting the receptors for phagocytosis on immune system cells; or

d) reducing the respiratory burst and release of reactive oxygen species in inflammatory cells.

9. A method of identifying (i) the anti-inflammatory capacity and (ii) the concentration of MGO-modified apalbumin protein in a sample of honey, wherein the MGO-modified apalbumin protein is an MGO-modified apalbumin 1 protein, or an MGO-modified apalbumin protein or fragment thereof comprising at least 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% or 100% sequence identity to the amino acid sequence set forth in SEQ ID NO:1, said method comprising the steps of:

a) assaying the fluorescence of the honey sample, and

b) correlating the measure of fluorescence of the honey sample with the anti-inflammatory capacity of the honey sample, by comparing the measure of fluorescence of a sample of honey and the anti-inflammatory capacity of one or more samples of honey with previously measured capacity to inhibit phagocytosis.

10. The method of claim 9, wherein the MGO-modified apalbumin protein is an MGO-modified apalbumin 1 protein.

11. The method of claim 9 or claim 10, wherein:

a) the method is used to enable a bee keeper to determine the right time to harvest honey from a hive in order to obtain a honey sample containing a desired anti-inflammatory capacity and MGO-modified apalbumin protein content; or

b) the method is used to enable a honey producer to determine a desired length of time to store honey, in order to obtain a honey sample with a desired anti-inflammatory capacity and MGO-modified apalbumin protein content.

12. A method of increasing the anti-inflammatory capacity of an apalbumin 1 protein, or an apalbumin protein or fragment thereof comprising at least 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% or 100% sequence identity to the amino acid sequence set forth in SEQ ID NO:1, by chemically treating the protein or fragment thereof with MGO, formaldehyde, glyoxal and/or glutaraldehyde.

13. A method of increasing the anti-inflammatory capacity and MGO-modified apalbumin protein content of a sample of honey, wherein the MGO-modified apalbumin protein is an MGO-modified apalbumin 1 protein, or an MGO-modified apalbumin protein or fragment thereof comprising at least 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% or 100% sequence identity to the amino acid sequence set forth in SEQ ID NO:1, said method comprising the step of adding MGO or an MGO-precursor molecule to a honey sample.

14. The method of claim 12 or claim 13 wherein the MGO-modified apalbumin protein is an MGO-modified apalbumin 1 protein.