

Summary of the Invention

[0008] The present invention is premised on realization that stability the GALA formulation, can be improved by separating the formulation into a first Solution A having a pH of at least 7, generally 7.4-8 and a Solution B having a pH of less than 7, generally lower. Solution A includes a balanced salt solution. Solution B includes water, an antioxidant such as ascorbic acid, a reducing agent, in particular L-glutathione, a nitric oxide substrate such as L-Arginine and a sugar, such as D-glucose. This solution is maintained at a pH below 7, preferably 5, 4 or 3, and preferably with an oxygen content at zero parts per million. In an alternate embodiment of the present invention, Solutions A and B are formulated as stated above, with the exception that the sugar is added to Solution A and not in Solution B. Also, in an alternative formulation erythropoietin (EPO) can be added, preferably to Solution B.

[0008a] In one aspect, there is provided a kit for preserving an organ or tissue comprised of a first aqueous solution contained in a first container and a second solution contained in a second container wherein the first aqueous solution is comprised of a balanced salt solution and a sugar, and said first solution has a pH of from about 7.6 to about 8.0; and wherein the second solution is comprised of water, L-Arginine, reduced glutathione and ascorbic acid and said second solution has a pH of about 3 – 5.

[0008b] In another aspect, there is provided a method for preparing an organ or tissue preservation solution comprising preparing a first solution comprised of an aqueous balanced salt solution and a sugar with a pH of about 7.6 to 8.0; preparing a second solution comprised of water, L-Arginine, glutathione and ascorbic acid at and having a pH of about 3 - 5 wherein one of said first and second solutions includes a sugar; and at the point of use mixing the first solution together with the second solution.

[0008c] In another aspect, there is provided a method of making a solution for use in an organ, tissue or cell type preservation solution, the method comprising mixing water, glutathione and/or cysteinylglycine, L-Arginine, a sugar and a reducing

agent, and buffering said solution with a buffering agent so that the solution has a pH of from 3.0 to about 5.0.

[0008d] In yet another aspect, there is provided a solution for use in an organ, tissue or cell type preservation comprising water, L-Arginine, glutathione, a sugar, a reducing agent and a buffering agent, and optionally cysteinylglycine, wherein the solution has a pH of less than 7.

[0008e] In a further aspect, there is provided a kit for preserving an organ or tissue comprised of a first aqueous solution contained in a first container and a second solution contained in a second container wherein the first aqueous solution is comprised of a balanced salt solution, and said first solution has a pH of at least 7.0; and wherein the second solution is comprised of water, cysteinylglycine, reduced glutathione, ascorbic acid, a sugar, L-Arginine, a buffering agent, and water which has been purged with an inert gas to remove substantially all dissolved oxygen, and optionally cysteinylglycine, and said second solution has a pH of less than 7.

[0008f] In another aspect, there is provided a method for preparing an organ or tissue preservation solution comprising preparing a first solution comprising forming a balanced salt solution having a pH of from 7.6 to about 8.0; preparing a second solution comprised of water, D-glucose, L-Arginine; cysteinylglycine and ascorbic acid at a pH of about 3 - 5; and wherein one of said first and second solutions includes a sugar; and at the point of use, mixing the first solution together with the second solution.

[0008g] In yet another aspect, there is provided a method of preserving living tissue or organ comprising combining a first aqueous solution with a second aqueous solution; wherein said first aqueous solution is comprised of a balanced salt solution and is at a pH of at least 7; wherein said second solution is comprised of water reduced glutathione, ascorbic acid, L-Arginine at a pH of 5.0 or less to form a combined solution wherein one of said first and second solutions includes a sugar; and contacting said tissue with said combined solution.

[0008h] In a further aspect, there is provided a method of preserving living tissue or organ comprising combining a first aqueous solution with a second aqueous

solution; wherein said first aqueous solution comprises a balanced salt solution having a pH of 7.6 to about 8.0; and wherein said second solution comprises water, L-Arginine, reduced glutathione, ascorbic acid and, optionally, cysteinylglycine at pH of 3-5, wherein one of said first and second solutions includes a sugar, thereby forming a combined solution; and contacting said tissue with said combined solution.

Brief Description of the Drawings

[0009] FIG. 1 is a perspective view of a multi-chamber bag for use in the present invention;

[00010] FIG. 2 is a perspective view of a kit having a first and a second container for use with the present invention;

[00011] FIGS. 3A and 3B are graphs representing the concentration over time at accelerated storage conditions of glutathione, ascorbic acid and Arginine;

[00012] FIG. 4 are two graphs depicting the degradation rate of L-glutathione in Solution B; and

[00013] FIGS. 5A-5D are diagrammatic depictions of the method of practicing the present invention.

Detailed Description

[00014] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Although any methods and materials similar or

WHAT IS CLAIMED IS:

1. A kit for preserving an organ or tissue comprised of a first aqueous solution contained in a first container and a second solution contained in a second container wherein the first aqueous solution is comprised of a balanced salt solution and a sugar, and said first solution has a pH of from about 7.6 to about 8.0; and wherein the second solution is comprised of water, L-Arginine, reduced glutathione and ascorbic acid and said second solution has a pH of about 3 - 5.
2. The kit of claim 1 wherein the first solution and/or the second solution are formulated in a gel, ointment, lotion or hydrogel.
3. A method for preparing an organ or tissue preservation solution comprising:
preparing a first solution comprised of an aqueous balanced salt solution and a sugar with a pH of about 7.6 to 8.0;
preparing a second solution comprised of water, L-Arginine, glutathione and ascorbic acid at and having a pH of about 3 - 5 wherein one of said first and second solutions includes a sugar; and
at the point of use mixing the first solution together with the second solution.
4. A method of making a solution for use in an organ, tissue or cell type preservation solution, the method comprising mixing water, glutathione and/or cysteinylglycine, L-Arginine, a sugar and a reducing agent, and buffering said solution with a buffering agent so that the solution has a pH of from 3.0 to about 5.0.
5. The method of claim 4, wherein the sugar is glucose.
6. The method of claim 4, wherein the reducing agent is ascorbic acid.
7. A solution for use in an organ, tissue or cell type preservation comprising water, L-Arginine, glutathione, a sugar, a reducing agent and a buffering agent, and optionally

cysteinylglycine, wherein the solution has a pH of less than 7.

8. The solution of claim 7 wherein the sugar is glucose.
9. The solution of claim 7 wherein the reducing agent is ascorbic acid.
10. The solution of claim 7 wherein the cysteinylglycine is substituted for glutathione.
11. A kit for preserving an organ or tissue comprised of a first aqueous solution contained in a first container and a second solution contained in a second container wherein the first aqueous solution is comprised of a balanced salt solution, and said first solution has a pH of at least 7.0; and wherein the second solution is comprised of water, cysteinylglycine, reduced glutathione, ascorbic acid, a sugar, L-Arginine, a buffering agent, and water which has been purged with an inert gas to remove substantially all dissolved oxygen, and optionally cysteinylglycine, and said second solution has a pH of less than 7.
12. The kit of claim 11, wherein the cysteinylglycine is substituted for reduced glutathione.
13. A method for preparing an organ or tissue preservation solution comprising;
preparing a first solution comprising forming a balanced salt solution having a pH of from 7.6 to about 8.0;
preparing a second solution comprised of water, D-glucose, L-Arginine; cysteinylglycine and ascorbic acid at a pH of about 3 - 5; and wherein one of said first and second solutions includes a sugar; and
at the point of use, mixing the first solution together with the second solution.
14. The method of claim 13 wherein the second solution is further comprised of reduced glutathione.
15. A method of preserving living tissue or organ comprising:

combining a first aqueous solution with a second aqueous solution; wherein said first aqueous solution is comprised of a balanced salt solution and is at a pH of at least 7; wherein said second solution is comprised of water reduced glutathione, ascorbic acid, L-Arginine at a pH of 5.0 or less to form a combined solution wherein one of said first and second solutions includes a sugar; and contacting said tissue with said combined solution.

16. The method claimed in claim 15 wherein said pH of said first solution is about 8 and the pH of said second solution is about 3.
17. The method claimed in claim 15 wherein cysteinylglycine is substituted for glutathione in said second solution or said second solution further includes cysteinylglycine.
18. The method claimed in claim 15 wherein said sugar is glucose.
19. The kit of claim 1, wherein the pH of the first solution is 8.0 and the pH of the second solution is 3.0.
20. A method of preserving living tissue or organ comprising:

combining a first aqueous solution with a second aqueous solution; wherein said first aqueous solution comprises a balanced salt solution having a pH of 7.6 to about 8.0; and wherein said second solution comprises water, L-Arginine, reduced glutathione, ascorbic acid and, optionally, cysteinylglycine at pH of 3-5, wherein one of said first and second solutions includes a sugar, thereby forming a combined solution; and contacting said tissue with said combined solution.