McCully, K. S. Annals of Clinical and Laboratory Science, 24:134–152 (1994)
McKnight, G. L. et al., W.O. Patent No. 93/21330 (1993)
Meister, A. and Griffith, O. W., Methods in Enzymology, 113:445–451 (1985)
Meister, A., in Dolphin, D. et al., (Eds.), *Glutathione,* New York: Wiley, 367–474 (1989)
Meister, A., Methods in Enzymology, 113:438–445 (1985)
Mohan, O. E. et al., Respiration Physiology 86:159–170 (1991)
Mohan, O. E., et al. Respiration Physiology, 86:159–170 (1991)
Morimoto, C. and Schlossman, S. F., Immunological Reviews, 161:55–70 (1998)
Nerlich, A. G. et al., Diabetes, 47:170–178 (1998)
Nieuwenhuys, C. M. A. et al., *Arteriosclerosis Thrombosis and Vascular Biology,* 18:1480–1489, (1998)
Nilsson, K. et al., Europ. J. of Clin. Invest., 26:853–859 (1996)
Nishi, K. et al. European Patent No. 0 824 149 A2 (1998)
Nissen, S. L., et al., U.S. Pat. No. 5,628,328 (1997)
Nygard, O. et al., N. E. J. of Med. 337:230–236 (1997)
Oberley, L. W., Free Radical Biology and Medicine, 5:113–124 (1998)
Ohlhauser, C. et al., Onkologie, 20:126–131 (1997)
Packer, L. (Ed.), *Nitric Oxide* (*Part A, Methods in Enzymology,* Vol. 268), 1–489 (1996)
Packer, L. (Ed.), *Nitric Oxide* (*Part B, Methods in Enzymology,* Vol. 269), 1–467 (1996)
Patterson, B., Metabolism, 46:322–329 (1997)
Pawlotsky, J. M. et al., Journal of Medical Virology, 54:26–37 (1998)
Picot, D. et al., Gastroenterol. Clinique et Biologique, 21:562–566 (1997)
Rahfeld, J. et al., Biological Chemistry (Hoppe-Seyler), 372:313–318 (1991)
Redgrave, T. G. and Martins, I. J., U.S. Pat. No. 5,756,067 (1998)
Rinderknecht, H. in Go, V. L. W. et al., (Eds.), The Exocrine Pancreas: Biology, Pathophysiology, and Diseases, New York: Raven Press, 163–183 (1986)
Robinson, G. B., Biochemical Journal, 108:275–285 (1968)
Sandier M. and Smith, H. J., (Eds.) Design of Enzyme Inhibitors as Drugs, Oxford, Oxford University Press, 1–827 (1994)
Schaffer, M. and Barbul, A., British Journal of Surgery 85: 444–460 (1998)
Sedo, A. et al., Physiological Reviews, 45:169–176 (1996)
Shankar, R. R. et al., Metabolism, 47:573–577 (1998)
Sies, H. (Ed.), Antioxidants in Disease Mechanisms and Therapy (Advances in Pharmacology, Vol. 38), 1–415 (1997)
Simonian, N. A. and Coyle, J. T., Ann. Rev. Pharmacol. and Toxicol. 36:83–106 (1996)
Skidgel, R. A. and Erdos, E. G., Immunological Reviews, 161:129–141 (1998)
Stamler, J. S. and Slikva, A., Nutrition Reviews, 1:1–130 (1996)
Svendsen, L. G. U.S. Pat. No. 4,070,245 (1978)
Szewczuk, A. and Wellman-Bednawska, M., Clinica Chimica Acta, 84:19–26 (1978)
Tate, S. S. and Meister, A., Methods in Enzymology, 113:400–419 (1985)
Topliss, J. G., (Ed.), Quantitative Structure-Activity Relationships of Drugs, New York: Academic Press, 1–375 (1983)
Tsai, K. et al., Gut, 42:850–855 (1988)
VanHoof, G. et al., FASEB Journal, 9:736–744 (1995)
Vann, L. S. et al., Proceedings of the Western Pharmacology Society 20:91–95 (1977)
Vann, L. S. et al., Proceedings of the Western Pharmacology Society, 20:91–95 (1977)
Vervloet, M. G., at al., Seminars in Thrombosis and hemostasis, 24:33–44 (1998)
Vita, J. A. et al., Journal of Clinical Investigation 101:1408–1414 (1998)
Voisin, L. et al., Journal of Clinical Investigation, 97:1610–1617 (1996)
Wagner, D. A. et al., U.S. Pat. No. 5,386,832 (1995)
Wagner, J. G. Pharmacokinetics for the Pharmaceutical Scientist, Lancaster (Pa.): Technomics Publishing Co., 1–316 (1993)
Wagner, J. G., J. Pharmacokinetics and Biopharmaceutics, 5:443–478 (1976)
Watkins, P. B., U.S. Pat. No. 5,100,779 (1992)
Weichert, W. and de Graaf, A. A., Advances in Biochemical Engineering, 54:1–151 (1996)
White, R. D. et al., Acute Toxicity Data, 1:164–165 (1992)
Wielders, S. et al., Thrombosis and Haemostasis 77:629–636 (1997)
Wolfe, R. R., Radioactive and Stable Isotope Tracers in Medicine, New York: Wiley-Liss, 1–395 (1992)
Yokoi, I. Et al., Neuropharmacology, 33:1261–1265 (1994)

While the present invention has been described in conjunction with a preferred embodiment, one of ordinary skill, after reading the foregoing specification, will be able to effect various changes, substitutions of equivalents, and other alterations to the compositions and methods set forth herein. It is therefore intended that the protection granted by Letters Patent hereon be limited only by the definitions contained in the appended claims and equivalents thereof.

What is claimed is:

1. A method of determining the in vivo conversion activity of a Class I, II or III gateway enzyme, said method comprising the steps of:

identifying a Class I, II or III gateway enzyme to be assayed;

selecting a labelled metaprobe for said enzyme, said metaprobe being selected so that when acted upon by said enzyme, at least one labelled end product that is directly detectable is produced;

administering to a patient a defined amount of said labelled metaprobe; and

determining the extent of conversion of said metaprobe to said labelled end product by said enzyme.

2. The method of claim **1** wherein said gateway enzyme is dipeptidyl peptidase IV and said metaprobe is glycyl-L-prolyl-L-2-aminobutyric[1-^{13}C] acid.

3. The method of claim **1** wherein said gateway enzyme is dipeptidyl peptidase IV and said metaprobe is glycyl-L-prolyl-p-aminobenzoic[1-^{13}C] acid.

4. The method of claim **1** wherein said gateway enzyme is thrombin and said metaprobe is N-acetyl-D-phenylalanyl-L-prolyl-L-arginyl-p-aminobenzoic[1-^{13}C] acid, ethyl ester.

5. The method of claim **1** wherein said gateway enzyme is thrombin and said metaprobe is N-acetyl-alycyl-L-prolyl-L-arginyl-p-aminobenzoic[1-^{13}C] acid, ethyl ester.

6. The method of claim **1** wherein said gateway enzyme is thrombin and said metaprobe is N-acetyl-D-phenylalanyl-L-prolyl-L-arginyl-2-aminobutyric[1-^{13}C] acid, ethyl ester.

7. The method of claim **1** wherein said gateway enzyme is thrombin and said metaprobe is N-acetyl-L-glycyl-L-prolyl-L-arginyl-2-aminobutyric[1-^{13}C] acid, ethyl ester.