

Curriculum Vitae

ROGER A. LAINE

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Baton Rouge, LA 70803

Personal Information:

Birthplace: Cloquet, Minnesota, USA

Education:

B.A., Zoology, Minor: Chem., 1964. University of Minnesota, Minneapolis, Minn.
Ph.D., Dept. Biological Sciences, Biochemistry Area, 1970, Rice University, Houston,
Mentor, Professor Alan D. Elbein

Postdoctoral Training:

- with Professor Charles C. Sweeley, 1970-1972, Biological Mass Spectrometry of
Carbohydrates, Department of Biochemistry. Michigan State University, East Lansing, MI
-with Professor Sen-itiroh Hakomori, (Member: National Academy of Sciences)
Departments of Pathobiology and Microbiology, 1972-1975
University of Washington, Seattle, WA

Research and Professional Experience

2016 Spring Semester January-May: Visiting Professor, Kyoto University, Kyoto, Japan.
2001 to present: Adjunct Professor, Dept. of Entomology, Louisiana State University
2010 to present: President and CEO, TumorEnd, LLC (www.tumorend.com)

1997-present: Professor of Biochemistry

Biochemistry and Molecular Biology Program
Dept. of Biological Sciences, Louisiana State University

1994-Aug.-Dec. Visiting Professor, Ronzoni Institute, University of Milano, Italy

1990-Present: Professor, Department of Chemistry

1988-1991: Chief Scientist, Scientific Founder, Glycomed, Inc., Alameda, CA.

1983-1988: Chair, Department of Biochemistry, LSU.

1983- 1997: Professor, Department of Biochemistry,
College of Basic Sciences,
Louisiana State University and The LSU Agricultural Center

1994- 2004: President and Founder, Anomeric, Inc., Baton Rouge, LA
Microbial Diagnostics:

2008 -Founder and Member, Citrazone, LLC, insect active compounds.

2009 - Founder and CEO, TumorEnd, LLC, human cancer therapeutics

2010 - Founder and CEO, TumorVet, LLC, 2009, Veterinary cancer therapeutics

2011 – President, GlyconPharma, LLC, Birmingham, Al, and Baton Rouge, LA.

2014 – Founder and CEO, Enzomeric, LLC, Microbial Diagnostics

Member of Boards of Directors:

International Medical Innovations, Inc., Birmingham, AL, 2001-2007
Agratech, Inc., Princeton, New Jersey, 2001-2003
SeaPolymers, LLC, New Orleans, LA 2002-2006

Member of Scientific Advisory Boards

Phage Therapeutics, Inc., Bothell, WA, 1997-2000
Demeter, Inc., Pittsburgh, PA, 1998-2002
Chair, SAB: International Medical Innov., Birmingham, AL, 2001-2007
RIKEN Frontier Research Advisory Board, Tokyo, 2000-2009
Chair, SAB: Agratech, Inc., Princeton, NJ, 2002-2003
Chair, SAB: IMI, Birmingham, AL 2001-2007

Grant review panels: (recent)

DOE site visit to CCRC (Complex Carbohydrates Research Center), University of Georgia, Athens, GA. 2008, 2012, 2015.
NSF SBIR Panels: 3 in 2008, 3 in 2009, 3 in 2010, 4 in 2011, 4 in 2012
DOE SBIR Panel: 1 in 2009
DOE Grant Review Panel: 1 in 2014
NIH SBIR Panel: 1 in 2013

1983-1997: Director, LSU Mass Spectrometry Facility, B-24/B9 Choppin Hall
(aggregate \$2 Million in Mass Spectrometer grants to equip facility)

1987-1993: Member, Scientific Advisory Board, and Consultant:
Glycomed, Inc., 860 Atlantic Ave., Alameda, CA 94501

1988-1990: Chief Scientist, 3rd employee and a Scientific
Founder of Glycomed Inc., Alameda, CA (NASDAQ LGND)
(IPO, 1991, \$150,000,000 total)

1983-1988 Chairman, Dept. of Biochemistry
Louisiana State University and The Louisiana Agricultural Center.

1975-1983 Assistant Professor, Associate Professor,
Department of Biochemistry
University of Kentucky-Medical, Lexington.

1973-1974 Research Asst. Professor
Depts of Pathobiology and Microbiology
University of Washington, Seattle

1972-1973 Postdoctoral Research Associate (Sen-itiroh Hakomori)
Depts of Pathobiology and Microbiology
University of Washington, Seattle

1970-1972 Postdoctoral Research Associate (C.C. Sweeley)
Dept. of Biochemistry
Michigan State University, East Lansing

1967-1970 Ph.D. Graduate Program, Dept. Biol. Sci. ,
Rice University, Houston Texas

1964-1966 Sales, Dental Equipment and Supplies
The M.F. Patterson Dental Supply, Houston, Texas

1962-1964 Direct door-to-door sales: Encyclopedias
The Grolier Society, Minneapolis, MN

Professional Society Memberships: (past and present)

American Chemical Society
Society for Glycobiology
American Society for Mass Spectrometry
American Society of Biological Chemists
American Association for the Advancement of Science
American Chitoscience Society
European Chitoscience Society

Honors:

Advisor, Riken Institute Frontier Research Program 2000-2009
Elected Fellow, American Academy of Inventors, 2018

Research Grant Support:

2000 NIH NIAID SBIR: \$100,000, Title: Rapid Bacterial Screening in Urinalysis (May 2000- October 2000, Awarded to Anomeric, Inc, WCJ Lo, PI.

1999-2002: LEQSF-(99-02)-RD-B-05-\$130,000 (July, 1999 - June, 2002)
Title: Rapid Antibiotic Sensitivity Assay. Plus \$90,000 Industrial Matching from Anomeric, Inc. RA Laine, PI

1999-2002: LEQSF-(1999-02)-RD-B-02-\$150,000 (July, 1999 - June 2002)
Title: Detection Devices for Formosan Termites
(co-PI with Gregg Henderson, Dept. of Entomology)

1999-2002: LEQSF-(99-02)-RD-B-11-\$130,000 (July, 1999 - June, 2002)
Title: Glylons, New Class of biomass polymers, Ioan Negelscu, PI, RA Laine, Co- PI. \$130,000 over 3 years + \$30000 Industrial Matching From International Medical Innovations, Birmingham, AL

2002. USDA-ARS, Biology and control Formosan subterranean termite
(with Gregg Henderson, Entomology \$266,825)

1999-2004. USDA-ARS, Vetiver Grass Extracts and Other Natural Extracts
(with Gregg Henderson, Entomology \$1,405,213)

2004-2006: USDA-ARS, Vetiver Grass Extracts and other Natural Extracts
(with Gregg Henderson, Entomology: \$300,000@\$60,000/year.

2005-2006: Sabbatical Professorial Researcher Masaya Ohta, Fukuyama University, 1 year award, salary equivalent: \$75000

2007: LEQSF-(2007-8)-ENH-\$130,000 for Liquid-Chromatograph-Mass Spectrometer (with Gregg Henderson, Entomology)

2008-2009: Postdoctoral Award to Masao Miyazaki, Roger A Laine, Host Laboratory, from Japanese Ministry direct to Dr. Miyazaki. 18 months Salary support and travel, \$150,000.

2012: SBIR grant from NCI to TumorEnd, LLC, \$150,000 for 6 months with \$60,000 State Matching Funds, Structure-Activity-Relationship of CM101 Streptococcal Toxin. Betty Zhu, PI.

- 2013: SBIR grant from NIGMS to TumorEnd, LLC, , \$150,000 for 6 months with \$60,000 State Matching Funds, Anti-inflammatory compounds inhibitors of Selectin ligand synthesis, Khushi Matta, PI.
- 2014 PFUND Grant from LSU Board of Regents, NSF Program: \$10,000 for 1 year.
- 2016-2018 BOR-NSF grant for optimization of organic synthesis of nootkatone \$40,000 1 year
- 2019 BOR-Lift2 Grant for Development of Mouse Tumor Hemorrhage Assay for polysaccharide therapeutics: \$43000, One Year.

TEACHING: Undergraduate: BIOL4087 (Senior Biochemistry for Pre-med) Summer 2007
Graduate Courses: BIOL7290 (Complex Carbohydrates) Fall Semesters, 1994-2010.
BIOL4097 (Biochemistry of Aging) Spring Semesters 2001-2010, thereafter Spring and Fall Semesters ongoing Fall 2016.

PUBLICATIONS:

Book Chapters:

1. Esselman, WJ, Laine, RA and Sweeley, CC: Isolation and characterization of glycosphingolipids, **Methods in Enzymology 28:** 140-156 (Academic Press, New York, 1972).
2. Forsee, WT., Laine, RA., Chambers, JP and Elbein, AD: UDP-glucose- β -sitosterol: glucosyltransferase of developing cotton seeds, **Methods in Enzymology 28:** 478-482 (Academic Press, New York, 1972).
3. Laine, R. A., Esselman, W. J. and Sweeley, C. C.: Gas-liquid chromatography of carbohydrates, **Methods in Enzymology 28:** 159-167 (1972).
4. Hakomori, S., Gahmberg, C. G., Laine, R. and Kijimoto, S.: (1974) Growth behavior, cell contact and surface structure of cells, in **Control of Proliferation in Animal Cells** (ed. by R. Baserga & B. Clarkson) p. 461 (Cold Spring Harbor Laboratory, NY, 1974).
5. Hakomori, S., Gahmberg, C. G., Laine, R. A. and Kiehn, D. (1974) Growth behavior of transformed cells as related to the surface structure of glycolipids and glycoproteins, in **Membrane Transformations in Neoplasia:** Miami Winter Symposia 8: p. 69-102 (ed. by J. Schultz and R. Block, Academic Press, NY, 1974).
6. Hakomori, S., Watanabe, K. and Laine, R. A.: Glycosphingolipids with blood group A, H and I activity: their status in group A1 and A2 erythrocytes and their changes associated with ontogeny and oncogeny, in **Human Blood Groups** (Karger, Basel, 1977) p. 150-163.
7. Young, W.W., Jr., Laine, R. A. and Hakomori, S.: Covalent attachment of glycolipids to solid supports and macromolecules, **Methods in Enzymol. 50:** Part C (1977).
8. Kaul, K., Hsieh, T. C.-Y., Laine, R. A. and Lester, R. L.: Characterization of glycosphingolipids from tobacco leaves, in **Glycoconjugate Research Vol. 1:**, pp. 181-183, ed. by J. D. Gregory and R. W. Jeanloz, Academic Press, New York (1979).
9. Hancock, L. W., Hsieh, T. C.-Y. and Laine, R. A.: Release of complex carbohydrates into culture medium by hamster cells, in **Glycoconjugate Research, Vol. II:** pp. 673-675, ed. by J. D. Gregory and R. W. Jeanloz, Academic Press, New York (1979).
10. Laine, R. A.: Chemical ionization gas-liquid chromatography-mass spectrometry in the structural analysis of saccharide chains, in **27th International Congress of Pure and Applied Chemistry** (ed. A. Varmavuori) p. 193-198, Pergamon Press (1980).
11. Jones, M.Z., Cunningham, J.G., Dade, A.W., Dawson, G., Laine, R.A., Williams, C.S.F., Alessi, D.M., Mostosky, U.V. and Vorro, J.R.: Caprine β -Mannosidosis, in **Proceedings of International Symposium on Animal Models of Inherited Metabolic Disease** (ed. D.G. Scarpelli, R.J. Desnick) Alan R. Liss, publishers, N.Y. (1982).
12. Laine, R.A. (1982) "Glycophosphosphingolipids, 'Ganglioside-like' glycolipids from plants and fungi" in **Vistas in Glycolipid Research** pp 115-120 (ed. Makita, Handa, Taketomi, Nagai) (Plenum Publishing Corp.)
13. **MAJOR RESEARCH FINDING PUBLISHED IN A BOOK CHAPTER:** Laine, R.A. and Rush, J.S. (1988) "Chemistry of Human Erythrocyte Polylactosamine Glycopeptides (Erythroglycans) as Related to ABH Blood Group antigenic Determinants: Evidence that Band 3 Carbohydrate on Human

- Erythrocytes Carries the Majority of ABH Blood Group Substance" *in Molecular Immunology of Complex Carbohydrates* (A. Wu, E. Kabat, Eds.) Plenum Publishing Corporation, N.Y. NY.
14. Laine, R.A. and Hsieh, T.C.-Y. (1987) "Inositol- Containing Glycophosphosphingolipids", **Methods in Enzymology 138**: 186-195. (V. Ginsburg, Ed.)
 15. Laine, R.A., Fisher, S.J., and Zhu, B.C.R., (1987) "Preparation of Human Placental Fetal Tissue Fibronectin and its Carbohydrates", **Methods in Enzymology 144**: 420-429 (L. Cunningham, ed.).
 16. Laine, R.A. (1989) "Tandem Mass Spectrometry of Oligosaccharides". **Methods in Enzymology. 179**: 157-164.
 17. Laine, RA (1990) Glycoconjugates: Overview and Strategy *in* Mass Spectrometry, **Methods Enzymol. 193**: 539-553. (ed: JA McCloskey)
 18. Laine, RA (1992) Mass Spectrometry of Carbohydrates *in Glycoconjugates, Composition, Structure and Function* pp 103-120 (ed. H.J.Allen, E.C. Kisailus) Marcel Dekker, Inc., New York.
 19. Roger A. Laine, 1995, "Glycosaminoglycans and related structures as potential inhibitors for erythrocyte infection by Plasmodium falciparum malaria" *in Non-Anticoagulant Actions of Glycosaminoglycans*. The 1994 Villa Vigoni Symposium, Como, Italy, Plenum Publications, London, (Eds. J. Harenberg and B. Casu)
 20. Laine, R.A., 1997, "The Information Storing Potential of the Sugar Code, *in Glycosciences, Status and Perspectives*: H-J and S. Gabius, Ed. , Chapman and Hall, Weinheim.
 21. Zhu, BCR and Roger A. Laine, 1997 "Depolymerization of chitin with chitinases" *in Chitin Handbook*, Edited by Riccardo A. A. Muzzarelli and Martin G. Peter, European Chitin Society, Atec, Grottammare, ISBN 88-86889-01-1
 22. Henderson, G., B. C. R. Zhu, S. Ibrahim. A. Sauer, W. Crowe and R. A. Laine. (2004). Structural activity of natural pharmacophores against the Formosan subterranean termite. American Chemical Society Symposium Series.
 23. **MAJOR RESEARCH FINDING PUBLISHED IN A BOOK CHAPTER:** Laine, RA, Lo, WCJ, Zhu, CRB, 2007, "Catalytically Inactive Endoglycosidases as Microbial Diagnostic Reagents: Chitinases and Lysozymes as Fungal and Bacterial Capture/Label Agents", ISBN-13: 978-0-444-53077-6, *in Lectins – Analytical Technologies*, Ed. Carol Nilsson, Elsevier B.V. pp: 373-384. Six resulting Patents from this work
 24. Ibrahim, S. A.; G. Henderson; R. Cross; J. Sun and R. A. Laine (2007): Potential Target Site Activity of Nootkatone and Tetrahydronootkatone on Formosan Subterranean Termite (Isoptera: Rhinotermitidae). African Crop Science Conference Proceedings, Minia University, El-Minia, Egypt, 27-31 October, 2007, Volume 8, Part 2 of 4: 1125-1131.
 25. Ibrahim, S. A.; G. Henderson, R. A. Laine and A. M. Younis (2007). Toxicity of naphthalene and 10 related compounds on *Coptotermes formosanus* (Isoptera: Rhinotermitidae). African Crop Science Conference Proceedings, Minia University, Egypt, 27-31 October, 2007, Volume 8, Part 2 of 4: 1133-1142.
 26. EDITOR: Laine, Roger A., Introduction to the Special Issue on Glycobiology and Sphingobiology, *Biochimica et Biophysica Acta (BBA) - General Subjects*, Volume 1780, Issue 3, March 2008, Pages 323-324. Glycobiology and Sphingobiology, Editors, Carl G. Gahmberg and Roger A Laine.
 27. Ibrahim, SA, Henderson, G, and Laine, RA, 2009, Structure activity relationships of naphthalene and 10 related compounds on *Coptotermes formosanus*, *in* Pesticides in Household, Residential and Structural Pest Management. Peterson, C. J., and Stout, D. M., eds. **ACS Symposium Series #1015, American Chemical Society, Washington, DC. Pp. 19-40.**

Peer-Reviewed Articles:

1. Laine, R. A. and Elbein, A. D.: Steryl glucosides in *Phaseolus aureus*: Use of gas-liquid chromatography and mass spectrometry for structural identification, **Biochemistry 10**: 2547-2553 (1971).

2. Laine, R. A. and Sweeley, C. C.: Analysis of trimethylsilyl-O- methyl oximes of carbohydrates by combined gas-liquid chromatography-mass spectrometry, **Analytical Biochemistry** **43**: 533-538 (1971).
3. Laine, R. A., Sweeley, C. C., Griffin, P. F. S. and Brennan, P. J.: Monoglucosyloxy-octa-decenoic acid, a glycolipid from *Aspergillus niger*, **Biochemistry** **11**: 2267-2271 (1972).
4. Laine, R. A., Sweeley, C. C., Li, Y.-T., Kistic, A. and Rapport, M. M.: On the structure of Cytolipin R, a ceramide tetrahexoside from rat lymphosarcoma, **J. Lipid Research** **13**: 519-523 (1972).
5. Laine, R. A., Sweeley, C. C.: o-methyl-oxime trimethylsilyl sugars : analysis by gas-liquid chromatography and mass spectrometry, **Carbohydrate Research** **27**: 199-213 (1973).
6. Laine, R. A. and Hakomori, S.: Incorporation of exogenous glycosphingolipids in plasma membranes of cultured hamster cells and concurrent change in growth behavior, **Biochem. Biophys. Res. Commun.** **54**: 1039-1045. (1973).
7. Laine, R. A., Stellner, K. and Hakomori, S.: Isolation and characterization of membrane glycosphingolipids, **Methods in Membrane Biol.** **2**: 205-247 (1973, ed: Korn, Plenum Press, New York).
8. Forsee, W. T., Laine, R. A. and Elbein, A. D.: Solubilization of a particulate UDP-glucose: sterol: glucosyl transferase in developing cotton fibers and seeds, and characterization of steryl 6-acyl-*D*-glucosides, **Arch. Biochem. Biophys.** **161**: 248-259 (1974).
9. Laine, R. A., Young, N. D., Gerber, J. N. and Sweeley, C. C.: Identification of 2-hydroxy fatty acids in complex mixtures of fatty acid methyl esters by mass chromatography, **Biomedical Mass Spectrometry** **1**: 10-14 (1974).
10. Yogeewaran, G., Laine, R. A. and Hakomori, S.: Mechanism of cell contact-dependent glycolipid synthesis: Further studies with glycolipid-glass complex, **Biochem Biophys Res Commun** **59**: 591-599 (1974).
11. Laine, R. A., Yogeewaran, G. and Hakomori, S.: Glycosphingolipids covalently linked to agarose gel or glass beads: Use of the complex for purification of antibodies against globoside and hematocide, **J. Biol. Chem.** **249**: 4460-4466 (1974).
12. Elbein, A. D., Forsee, W. T., Schultz, J. D. and Laine, R. A.: Biosynthesis and structure of glycosyl diglycerides, steryl-glucosides and acylated steryl-glucosides, **Lipids** **10**: 427-436 (1975).
13. Watanabe, K., Laine, R. A. and Hakomori, S.: On neutral fucoglycolipids having long, branched carbohydrate chains: H-active and I-active glycosphingolipids of human erythrocyte membranes, **Biochemistry** **14**: 2725-2733 (1975).
14. Hakomori, S., Watanabe, K. and Laine, R. A.: Glycosphingolipids with blood group A, H and I activity and their changes associated with ontogenesis and oncogenesis, **Pure and Appl. Chem.** **49**: 1215-1227 (1977).
15. Chien, J. L., Li, S.-C., Laine, R. A. and Li, Y.-T.: Characterization in gangliosides from bovine erythrocyte membranes, **J. Biol. Chem.** **253**: 4031-4035 (1978).
16. Hsieh, T. C.-Y., Kaul, K., Laine, R. A. and Lester, R. L.: Characterization of glycoposphoceramides from tobacco leaves, **Biochemistry** **17**: 3575-3581 (1978).

17. Jarnefelt, J., Rush, J., Li, Y.-T. and Laine, R. A.: Erythroglycan, a high molecular weight glycopeptide with the repeating structure [galactosyl-[1->4]-2-deoxy-2-acetamido-glucose-[1->3] comprising more than 1/3 of the protein-bound carbohydrate of human erythrocyte stroma, **J. Biol. Chem.** **253**: 8006-8009 (1978).
18. Steiner, S., Via, D., Klinger, M., Larriba, G., Laine, R. A. and Sramek, S.: Role of glycoconjugates in expression of the transformed phenotype in Glycoproteins and Glycolipids in Disease Processes, **American Chem. Soc. Symposium Series 80**: 378-403 (1978).
19. Weber, R., Deke, S. and Laine, R. A.: Absorption of the keto-analogs of the branched chain amino acids from rat small intestine (monitored by GC-MS of the quinoxalinol derivatives) **Gastroenterology** **76**: 62-70 (1979).
20. Hodges, L. C., Laine, R. A. and Chan, S. K.: Structure of the oligosaccharide chains in human alpha-1-protease inhibitor, **J. Biol. Chem.** **254**: 8208-8212 (1979).
21. Young, W. W., Laine, R. A. and Hakomori, S.: An improved method for the covalent attachment of glycolipids to solid supports and macromolecules, **J. Lipid. Res.** **20**: 275-278 (1979).
22. Frasch, S. F. and Laine, R. A.: Carbohydrate structure of the major glycopeptide from human cold insoluble globulin, **J. Supramol. Struct.** **11**: 391-399 (1979).
23. Laine, R. A., Hsieh, T. C.-Y. and Lester, R. L.: Glycophosphoceramides From Plants, in **American Chemical Society Symposium Series, Vol. 128**: p. 65-78 (1980).
24. Turco, S. J., Rush, J. S. and Laine, R. A.: Presence of erythroglycan on human K-562 CML-derived cells, **J. Biol. Chem.** **255**: 3266-3269 (1980).
25. Ashraf, J., Butterfield, D. A., Jarnefelt, J. and Laine, R. A.: Enhancement of the Yu and Ledeen gas chromatographic method of sialic acid estimation: Use of methane chemical ionization mass fragmentography, **J. Lipid. Res.** **21**: 1137-1141 (1980).
26. Rush, J.S., Turco, S.J. and Laine, R.A.: Erythroglycan biosynthesis in K-562 cells. Inhibition of synthesis by tunicamycin and lack of attachment to the G-protein of vesicular-stomatitis virus. **Biochem. J.** **193**: 361-365 (1981).
27. Bostock, R.M., Kuc, J.A. and Laine, R.A.: Eicosapentaenoic and arachidonic acids from phytophthora infestans elicit fungitoxic sesquiterpenes in potato. **Science** **212**: 67-69 (1981).
28. Jones, M.Z. and Laine, R.A.: Caprine oligosaccharide storage disease: Characterization of Man (β 1 - > 4) GlcNAc as the major stored substance. **J. Biol. Chem.** **256**: 5181-5184 (1981).
29. Hsieh, T. C.-Y, Lester, R.L. and Laine, R.A.: Glycophosphoceramides- from plants: Purification and characterization of a novel tetrasaccharide derived from tobacco leaf glycolipids, **J. Biol. Chem.** **256**: 7747-7755 (1981).
30. Klinger, M., Laine, R.A., and Steiner, S.: Characterization of novel amino acid fucosides, **J. Biol. Chem.** **256**: 7932-7935 (1981).
31. Russin, T.Z., Laine, R.A., and Turco, S.J.: Biosynthesis of Erythroglycan in a Microsomal Fraction from K-562 Cells. **Biochemical Journal** **197**: 327-332 (1981).
32. Matsuura, F., Laine, R.A. and Jones, M.Z.: Oligosaccharides accumulated in kidney of a goat with β -mannosidosis - Mass spectrometry of intact permethylated derivatives. **Arch. Biochem. Biophys.** **211**: 485-493 (1981).

33. Laine, R.A.: Increased sensitivity of methylation analysis using chemical ionization mass spectrometry. **Anal. Biochem.** **116**: 383-390 (1981).
34. Fisher, S. and Laine, R.A.: Malto-oligosaccharides in the syncytiotrophoblastic microvilli of first trimester human placentas. **Biochem. Journal** **200**: 93-98 (1981).
35. Jarnefelt, J., Rush, J.S., Viitala, J. and Laine, R.A.: Preparation of long chain glycopeptides (erythroglycan) from erythrocyte membranes: **Methods in Enzymol.** **83**: 311-320 (1982).
36. Kaur, K.J., Turco, S.J. and Laine, R.A.: Erythroglycan can be elongated by bovine milk UDP-galactose: D-glucose-4-beta-galactosyl-transferase. **Biochemistry International** **4**: 345-351 (1982).
37. Kaizu, T., Turco, S.J., Rush, J.S. and Laine, R.A. : Synthesis of the branched form of erythroglycan by Friend GM979 erythroleukemic cells. **J. Biol. Chem.** **257**: 8272-8277 (1982).
38. Townsend, R.R., E. Hilliker, Y.T. Li, R.A. Laine, W.R. Bell, and Y.C. Lee, (1982) Carbohydrate Structure of Human Fibrinogen: Use of 300 MHz NMR to Characterize Glycosidase-Treated Glycopeptides, **J. Biol. Chem.** **257**:9704-9710.
39. Richard M. Bostock, Roger A. Laine and Joseph A. Kuc (1982) Factors Affecting the Elicitation of Sesquiterpenoid Phytoalexin Accumulation by Eicosapentaenoic and Arachidonic Acids in Potato. **Plant Physiol.** **70**: 1417-1424.
40. Fisher, S.J. and Laine, R.A. (1984) High Amounts of alpha-Amylase Activity in the Brush Border of First Trimester Human Placenta, **J. Cellular Biochemistry** **22**: 47-54.
41. Maniara, G., Laine, R.A. and Kuc, J. (1984) Oligosaccharides from Phytophthora Infestans enhance the elicitation of Sesquiterpenoid stress metabolite accumulation by arachidonic acid in potato. **Physiol. Plant. Pathol.** **24**: 177-186.
42. Fisher, S.J. and Laine, R.A. (1984) External labeling of Glycoproteins on Microvilli from First Trimester Human Placentas, **Biochemical Journal** **221**: 821-828.
43. Hull, S.R., Laine, R.A., Kaizu, T., Rodriguez, I. and Carraway, K.L. (1984) Structures of the O-linked Oligosaccharides of the Major Cell Surface Sialoglycoprotein of MAT-B1 and MAT-C1 Ascites Sublines of the 13762 Rat Mammary Adenocarcinoma. **J. Biol. Chem.** **259**: 4866-4877.
44. Zhu, B. C.-R., Fisher, S.F., Pande, H., Calaycay, J., Shively, J.E., and R.A. Laine (1984) Human Placental (Fetal) Fibronectin: Increased Glycosylation and Higher Protease Resistance Than Plasma Fibronectin. **J. Biol. Chem.** **259**: 3962-3970.
45. Barr, K., R.A. Laine, and R.L. Lester (1984) Carbohydrate Structures of three novel Phosphoinositol-containing Sphingolipids from the yeast Histoplasma capsulatum **Biochemistry** **23**: 5589-5626.
46. Zhu, Betty C.-R., and R.A. Laine (1985) "Polylactosamine Glycosylation Weakens the Binding of Fibronectin to Gelatin" **J. Biol. Chem.** **260**: 4041-4045.
47. Friedman, M.J., Fukuda, M. and R.A. Laine (1985) "A Malaria Parasite Binding Site on the Major Transmembrane Protein of the Erythrocyte". **Science** **228**: 75-77.
48. Kahwa, I.A., Selbin, J., Hsieh, T.C.Y. and Laine, R.A. (1986) "Synthesis of Homodinuclear Macrocyclic Complexes of Lanthanides and Phenolic Schiff Bases" **Inorganica Chimica Acta** **118**: 179-185.

49. Arumugham, R.G., Hsieh, T.C.-Y, Tanzer, M.L. and Laine, R.A. (1986) "Structure of the Asparagine-Linked Sugar Chains of Laminin" **Biochimica Biophysica Acta** **883**: 112-126.
50. Falick, A.M., Walls, F.C. and Laine, R.A. (1986) "Cooled Sample Introduction Probe for Liquid Secondary Ionization Mass Spectrometry" **Anal. Biochem.** **159**: 132-137.
51. Laine, R.A. (1986) "Phosphorous-Containing Glycosphingolipids" **Chemistry and Physics of Lipids** **42**: 129-135.
52. Kahwa, I.A., Hsieh, T.C.Y., Laine, R.A., and Selbin, J. (1986) "Novel Gaseous Polyatomic Lanthanide Oxide Species Detected by Fast Atom Bombardment Mass Spectrometry" **Proceedings Annual Meeting of Society for Mass Spectrometry** p. 148. Peer Reviewed Extended Abstract, (The American Society for Mass Spectrometry).
53. Falick, A.M., Walls, F.C. and Laine, R.A. (1986) "Enhanced LSIMS Performance using a Sub-Ambient Sample Probe. **Proceedings Annual Meeting of Society for Mass Spectrometry**, p. 377 (Peer Reviewed Extended Abstract).
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ABSTRACTS: partial list

POLY 209-Synthesis and characterization of protected and unprotected glylons derived from D-galactaric acid

Author(s): Rosu Cornelia; Negulescu Ioan I.; Laine Roger A.; et al.

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Effect of juvenile hormone III on *Coptotermes formosanus* in a topical application bioassay
Lixin Mao, Louisiana State University Agricultural Center; Gregg Henderson, Louisiana State University Agricultural Center; Roger A. Laine, Louisiana State University, Annual Meeting, 2008 Entomological Society of America, Nov. 2008

Development and testing of new insecticidal wood preservatives.

Author(s): Henderson G; Smith WR; Laine RA

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Components of the Soldier Defense Gland of the Formosan Subterranean Termite: *Coptotermes formosanus*: Unusual Occurance of a new 5000 Da Lysozyme with No Homology to Known Lysozymes
Youshong Guo¹, Masaya Ohta², Marcus Hardt¹, Gregg Henderson³ and Roger A Laine^{1,3}, US/Japan Glyco2004, Joint meeting of the Society for Glycobiology and Japan Society for Glycobiology, November, 2004, to be published in *Glycobiology* (2004) 13:

Structure activity of natural pharmacophores against formosan subterranean termites.

Author(s): Henderson G; Laine RA

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Repellence of vetiver oils from different biogenic and geographical origins against Formosan subterranean termites (*Isoptera*: *Rhinotermitidae*) (Henderson G, B. Zhu, R.P. Adams, L. Mao, Y. Yu, and R. A. Laine). 77th Annual Meeting, Southeastern Branch, ESA, Baton Rouge, LA, 9-12 March 2003.

Research of the lysozyme from the frontal gland of the soldier caste of *Coptotermes formosanus*. (Henderson G, Y. Guo and R. A. Laine). 77th Annual Meeting, Southeastern Branch, ESA, Baton Rouge, LA, 9-12 March 2003.

Potential target site activity of novel plant products against termites. (Henderson G, R. K. Cross, S. A. Ibrahim, J. Z. Sun and R. A. Laine). 77th Annual Meeting, Southeastern Branch, ESA, Baton Rouge, LA, 9-12 March 2003.

Natural insecticidal compounds inhibit weed germination and growth. (Henderson G, L. Mao and R. A. Laine). 77th Annual Meeting, Southeastern Branch, ESA, Baton Rouge, LA, 9-12 March 2003.

Laboratory and field evaluation of 2-phenoxyethanol as an attractant and feeding stimulant to subterranean termites. (Henderson G, H. Fei, S. Ibrahim, R. A. Laine and W. Kong). 51st Annual Meeting of the ESA, Cincinnati, Ohio, 26-29 October, 2003.

Effect of fatty acid components of frontal gland secretion on Formosan subterranean termites (Henderson G, L. Mao and R. A. Laine). 51st Annual Meeting of the ESA, Cincinnati, Ohio, 26-29 October, 2003.

Structure toxicity relationship of naphthalene and 10 of its derivatives on Formosan subterranean termite (Isoptera: Rhinotermitidae). (Henderson G, S. Ibrahim and R. A. Laine). 51st Annual Meeting of the ESA, Cincinnati, Ohio, 26-29 October, 2003.

Biological and biochemical effects of eserine, tetrahydronootkatone and their mixture on the Formosan subterranean termite (Isoptera: Rhinotermitidae). (Henderson G, R. Cross, R. A. Laine and S. Ibrahim). 51st Annual Meeting of the ESA, Cincinnati, Ohio, 26-29 October, 2003.

Examining volatiles from Formosan subterranean termite samples for reporter molecules. (Henderson G, P. M. McLaughlin, L. Mao, B. C. R. Zhu and R. A. Laine). 51st Annual Meeting of the ESA, Cincinnati, Ohio, 26-29 October, 2003.

Bacterial and fungal detection systems based on catalytically inactive endoglycosidases

Author(s): Laine RA; Zhu BCR; Lo WCJ

Source: GLYCOBIOLOGY Volume: **11** Issue: **10** Pages: **902-903** Meeting Abstract: **116** Published: **OCT 2001**

Unusual trehalose-based oligosaccharides from a glycolipid fraction and the cytoplasm of Mycobacteria smegmatis.

Author(s): Ohta M; Pan YT; Laine RA; et al.

Source: GLYCOBIOLOGY Volume: **11** Issue: **10** Pages: **903-903** Meeting Abstract: **117** Published: **OCT 2001**

Site directed mutagenesis of the chitin-binding domain from B-circulans chitinase A1 and analysis by a green fluorescent protein-based binding assay

Author(s): Hardt M; Laine RA

Source: GLYCOBIOLOGY Volume: **11** Issue: **10** Pages: **907-907** Meeting Abstract: **131** Published: **OCT 2001**

Improved assay for GDP-Mannose 4,6-dehydratase

Author(s): McKee M; Zhu BCR; Laine RA

Source: GLYCOBIOLOGY Volume: **11** Issue: **10** Pages: **910-910** Meeting Abstract: **143** Published: **OCT 2001**

Incremented alkyl derivatives enhance collision-induced glycosidic bond cleavage in mass spectrometry of disaccharides

Author(s): Mendonca S; Cole RB; Zhu JH; et al.

Source: GLYCOBIOLOGY Volume: **11** Issue: **10** Pages: **931-931** Meeting Abstract: **207** Published: **OCT 2001**

Catalytically inactive endoglycosidases as microbial diagnostic probes

Author(s): Laine RA; Zhu BCR; Hardt M; et al.

Source: GLYCOBIOLOGY Volume: **10** Issue: **10** Pages: **1135-1135** Meeting Abstract: **214** Published: **OCT 2000**

Sugar nucleotide and metabolite separation by HPLC: GDP-mannose, GDP-fucose.

Author(s): McKee ML; Zhu BCR; Laine RA

Source: ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY Volume: **218** Pages: **U195-U195** Part: **Part 1** Meeting Abstract:**49-CARB** Published: **AUG 22 1999**

Alkyl-substituted anomeric pairs discerned by

MS-CID-MS. Author(s): **Laine RA**; Mendonca S; Zhu

JH; et al.Source: ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL

SOCIETY Volume: **218** Pages: **U210-U210** Part: **Part 1** Meeting Abstract:**96-CARB** Published: **AUG 22 1999**

Catalytically inactive enzymes for bacterial diagnostics.

Author(s): **Laine RA**; Zhu BCR; Lo WCJ

Source: ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL

SOCIETY Volume: **218** Pages: **U694-U694** Part: **Part 2** Meeting Abstract:**3-SCHB** Published: **AUG 22 1999**



Title: **Reporter molecules for Formosan termite infestation.**

Author(s): Henderson G; Chen J; **Laine RA**

Source: ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL

SOCIETY Volume: **218** Pages: **U699-U699** Part: **Part 2** Meeting Abstract:**22-SCHB** Published: **AUG 22 1999**

Abstracts published: >70

Patents, Applications, allowed and issued:

1. •Srnlka, C, Laine RA, Gilbert J., **1991**, Compositions and methods for preventing and treating rotaviral infections: US Patent #5053406-A.
2. • Abbas, SA, Nashed, MA, Dasgupta, F, Srnlka, CA, Laine RA, **1991**, "Synthesis of rotavirus receptor saccharides", WO/1991/008748, International Application PCT/US1990/007121.
3. • Dasgupta, F, Srnlka, CA, Laine, RA, **1991**, "Synthetic receptor molecules recognizable by rotavirus", WO/1991/008747, International Application PCT/US1990/007120.
4. •Brandley, BK, Lam, LH, Laine, RA, **1991**, Heparin Fragments as Inhibitors of Smooth Muscle Cell Proliferation: US Patent #5032679
5. •Laine, RA, Jaynes, JM, Ou, CY , **1994**, Molecular Clone: Chitinase Gene from *Vibrio Parahemolyticus* ,US Patent #5, 352,607
6. •HE Conrad, P Fugedi, B Brandley, LH. Lam, RA. Laine, January, **1995**, Sulfated Polysaccharides as Inhibitors of Smooth Muscle Cell Proliferation, US Patent # 5,380,716
7. •Laine RA and E Yoon, **1995**, Synthetic Oligosaccharides as Anti-inflammatory Precursors: US Patent Number #5,426,178
8. •Laine, RA and J YC Lo, **1996**, Diagnosis of Fungal Infections with a Chitinase, US Patent #5,587,292

9. •Laine, RA and Chin-Yih Ou, **1997**, “Thermostable, Salt Tolerant Wide pH Range Novel Chitobiase, 92A5.2”, US Patent #5,693,519.
10. •Laine, RA and Chin-Yih Ou, **1997**, “Thermostable, Salt Tolerant Wide pH Range Novel Chitobiase”, US Patent #5,602,020.
11. •Laine RA, Eunsun Yoon, U.S. Patent 5,618,705 - **1997**, Synthesis of anti-inflammatory compounds and novel trisaccharides useful in the synthesis of anti-inflammatory compounds.
12. •Laine RA, U.S. Patent 5,714,587, **1998**, Synthesis of anti-inflammatory compounds and novel trisaccharides useful in the synthesis of anti-inflammatory compounds.;
13. •Laine RA, US Patent No. 5,914,239, 6/22/ **1999**, "Diagnosis of Fungal Infections and a Chitin Binding Lectin useful in such Diagnosis".
14. •Laine RA and WC Jennifer Lo, U.S. Patent Serial No. 5,935,804, **1999**, "Method for Detecting Eubacteria in Biological Samples with Catalytically Inactive Murein Binding Enzymes"
15. •Henderson G, J. Chen and R.A.Laine, , US Patent # 5,874,097, **1999**, Compositions and methods for detecting and killing termites.
16. •Laine, RA and J YC Lo, US Patent #6093552, **2000**, Diagnosis of Fungal Infections with a Chitinase.
17. •Laine RA and WCJ Lo, U.S. Patent #6,090,573: **2000**, , Detecting Eubacteria and Fungus and Determining Their Antibiotic Sensitivity by Using Catalytically Inactive Murein Binding Enzymes
18. •Laine RA, US Patent No. 6,121,420, **2000**, "Diagnosis of Fungal Infections, and a Chitin-Binding Lectin Useful in Such Diagnoses"
19. •Laine RA, Jennifer Lo; Wai Chun, **2000**, “Murein binding polypeptide and antibiotic diagnostic reagents, methods and kits for detecting eubacteria and fungus in biological samples.” United States Patent 6,159,719
20. •Laine RA. , Lo; Wai Chun.Jennifer , **2001**, ”Isolation and purification of eubacteria and fungus with catalytically inactive murein binding enzymes”, United States Patent 6,184,027
21. •Henderson; Gregg, Chen; Jian, Laine; Roger A., **2002**, " Compositions and methods for detecting and killing termites" United States Patent 6,352,703
22. •Henderson, Gregg, Heumann, Donald O., Laine, Roger A., Maistrello, Lara, Zhu, Betty C.R., Chen, Feng, Extracts of vetiver oil as repellent and toxicant to ants, ticks, and cockroaches. US Patent Application #20030073748 Filing Date: April 17, 2003 Categories: Entomology
23. • Henderson, G, Zhu, B.C-R., Laine, Roger A., **2003**, “Extracts of Vetiver Oil as a Repellent and Toxicant to Termites, European Patent #1221854.
24. • Henderson, G, Zhu, B.C-R., Laine, Roger A., **2005**, “Extracts of Vetiver Oil as Termite Repellent and Toxicant, US Patent #6890960.
25. • Zhu, BCR, G Henderson and RA Laine, **2005**, "Dihydronootkatone and Tetrahydronootkatone as Repellents to Arthropods, US Patent #6897244.
26. • Sauer, A, Crowe, W, Laine, RA, Henderson, G, **2006**, Efficient and economic asymmetric synthesis of nootkatone, tetrahydronootkatone, their precursors and derivatives, US Patent #7,112,700.
27. • Henderson, G, SA Ibrahim, R. Patton, R.A. Laine, BCR Zhu and F Chen, "Naphthalene Derivatives as Termite Repellents and Toxicants” US Patent #7351744, April 1, 2008.
28. • Laine, RA, Henderson G, Calhoun, T., Muniruzzaman, S., Veillon, L, 2008, “Novel Insecticidal Agents Containing Carbohydrate Moieties And Methods Of Their Preparation And Use” Provisional Patent filed.
29. • Laine, RA, Henderson G, Calhoun, T., Muniruzzaman, S., Veillon, L., 2014, Inositol and Inositol Phosphates as Termiticides (provisional patent filed)
30. Laine, R.A., 2015, “Reaction Sequence for the Synthesis of Nootkatone, Dihydronootkatone and Tetrahydronootkatone” U.S. Patent Application No. 62/265,723.
31. Laine, RA, Veillon, L, Henderson, G., 2017, “Cyclohexylamine-based Compounds and Uses Thereof, US Patent Application Serial number 62/309,143

Patents in process: 2

Current: Seminars Presented and invited Lectures at International Meetings:

“Microbial Diagnostics based on Catalytically Impaired Binding Assays”, Mitsubishi Kasei Institute, Tokyo, Japan, October, 2003.

“Valencenoid derivatives, pharmacophores and biological activity on Formosan Subterranean Termites”, Mona Symposium on Natural Products, January 2004, Kingston, Jamaica

“Mutation of binding site amino acids alters substrate specificity for the *Bacillus circulans* chitinase chitin-binding domain” Shonan Village Center Hayama-machi Kanagawa, Japan, May 23-27, 2004

“Nootkatone sesquiterpene pharmacophores and biological activity on Formosan Subterranean Termites, Mosquitos and other insect pests: 9th Ibn Sina International Conference on Pure and Applied Heterocyclic Chemistry, Sharm El-Shiekh, Egypt, Dec. 11-14, 2004. (invited but did not attend due to terrorist dangers to hotels on the Red Sea).

Introductory Lecture: “The Career of Sen-itiroh Hakomori” Glycobiology and Sphingobiology, Tokushima, Japan, Feb. 2007. (meeting organizer).

Formosan Subterranean Termite (*Coptotermes formosanus*: Shirakii), “A look at their biochemical weaponry, including *free ceramides containing novel sphingosines*. and design of a few chemical insults of our own”, University of Georgia, Athens, 2007.

Formosan Subterranean Termite (*Coptotermes formosanus*: Shirakii), “A look at their biochemical weaponry, and design of a few chemical insults of our own including rare sugars”, New Orleans Carbohydrate Symposium, 2007.

Formosan Subterranean Termite (*Coptotermes formosanus*: Shirakii), “A look at their biochemical weaponry, including *free ceramides containing novel sphingosines*. and design of a few chemical insults of our own”, University of Miami Medical School, 2008.

“Rare Sugars effects on the Formosan Subterranean Termite (*Coptotermes formosanus*: Shirakii),” New Orleans Carbohydrate Symposium, 2008.

“The Curious Case of a Polysaccharide Biological Anti-Angiogenesis Developed in the 1990’s but not brought to commercial medical use”.

“2-halo sugars as termiticides.” New Orleans Carbohydrate Symposium, 2009

“Rare Sugars as Insect-Active Compounds”, 6th international Symposium on Rare Sugars, Takamatsu, Kagawa, Japan.

SialoGlyco Tiawan September 2012: Lecture “Relationship of Sialin to Cancer and Wound Healing Capillaries”, Taipei Taiwan.

Glyco 22: Dalian China, June, 2013: Lecture: “Sialin is a multifunctional Protein”

BITS Congress, Haikou, Hainan, China, 2014: “Sialin is a multifunctional Protein and a Tumor Therapeutic Target”.

National Meetings Organized:

1983 Annual meeting of the North American Society for Complex Carbohydrates (Now Society for Glycobiology), Oct. 1983, Lexington, Kentucky.

International Meetings Organized:

Organizer, with Glyn Dawson, The First International Meeting on Functions of Glycosphingolipids, July 17-23, 1990, Santa Barbara, CA.

Gordon Conference Founder, Vice Chairman and Co-Organizer, with Glyn Dawson, First Gordon Conference on Glycolipids and Sphingolipids, Kahuku, Hawaii, November 16-20, 1992.

Organizer, UCLA Keystone Conference on Carbohydrate-binding proteins and their Carbohydrate ligands, Keystone Colorado, January 24-31, 1993.

Chair, Gordon Research Conference on Glycolipids and Sphingolipids, Ventura, California, January 19-24, 1995.

Organizer: International Symposium on Glycobiology and Sphingobiology, Tokushima, Japan, February 27-March 1, 2007.

Administrative:

- Chairman of Biochemistry, LSU, 1983-1988

My employment at LSU began in 1983 as Chairman of Biochemistry and Director of the Mass Spectrometry Facility. During my tenure as Chairman from 1983-1988, several improvement indicators were incremented in the department. While there were 8 total faculty in 1982, of which only 5 were research active, we hired 7 total faculty over 5 years while 2 left and one did not obtain tenure. By 1985, all faculty in the department were research active, and we continued to hire new faculty who were very successful with their first grant proposals. The department stabilized at 12-13 members around 1988 until merging with other life sciences departments in 1999. Extramural funding in the department grew from \$300,000 in 1982 to \$2,500,000 (including institutional overhead) in 1988, where all 12 members of the faculty had independent extramural funds, of which 8 were NIH-based. The graduate program in Biochemistry had 12 Ph.D. students in 1982 and grew to 35 Ph.D. Students in 1988.

Entrepreneurial:

- Founding of Glycomed, Inc., 1987-1993.

In 1988, I accepted a position as a scientific founder and 3rd employee of a new biotechnology pharmaceutical company, Glycomed, Inc., Alameda, CA, whose mission statement was to develop pharmaceuticals from biologically active complex carbohydrates. This biochemical area, where I had worked in structural chemistry, had not yet been exploited for human drugs.

With permission of the Chancellor and Vice Chancellors of LSU, my professorial effort was reduced to 25% for 2 years, retaining NIH-grant supported research effort at LSU, and committing 75% of my time to directing start-up research, hiring of scientists, design of laboratories, procurement of equipment (2 NMR and 3 mass spectrometers), and raising venture capital at Glycomed. I was the third employee of Glycomed after 2 of the original founders Brian Atwood and John Klock, hired July 1, 1988. With the additional hire of a pharmaceutical company CEO, Alan Timms, we formed the executive group of Glycomed for the first two years.

During 2 years, with \$8M in Venture Capital, as research director, we hired 25 Ph.D.'s, 1 M.D. and 10 technicians, directed the research programs and gave more than 100 scientific progress talks to major pharmaceutical companies and venture capital firms. This effort resulted in 2 \$15M contracts with Eli Lilly and Genentech. In 1991, Glycomed went public, raising 60 million, \$11 million more in Venture Capital and \$50M more in 1992 for a total of \$150M capitalization. Glycomed merged with Ligand, Inc., San Diego (NASDAQ: LGND) in 1995 with \$85M in Cash.

After 2 years, returning to a Professorial position at LSU, in addition, during 1991-1993, I maintained a 20% effort as a member of Glycomed's Scientific Advisory Board and senior consultant. No further consulting or official contact with Glycomed occurred after 1993.

Biotechnology Ventures: 1994-Present

Anomeric®, **Inc.** - In 1994, RAL incorporated Anomeric, Inc., to develop, manufacture and market microbial and other diagnostics, beginning with a developed product "Fungalase™" for fungal diagnostics in plants, animals and humans. Technology developed in my laboratory was licensed from LSU and developed by Anomeric to marketable products. Anomeric's latest product is a pan-bacterial stain "Bacterase", developed for automated diagnostics. Fungalase™-F, was GMP manufactured in 1997 by Centocor, Inc., and cleared by the FDA April 28, 1997 as a Class I exempt chemical stain and dye. Anomeric obtained \$520,000 Venture Capital, and \$500,000 revenue to date. Anomeric was awarded an NIH National Institute of Allergy and Infectious Disease SBIR Phase I award of \$100,000 for rapid bacterial screening in bacteruria. Anomeric has also had contracts totaling \$400,000 with Sysmex, Inc., Japan, Becton-Dickinson, and Associates of Cape Cod/Seikagaku.

Citrazone, LLC was founded in 2008 by RAL, with a Baton Rouge business partner Brad Axelrod, to license out from LSU and commercialize a group of patented technologies centered around the nootkatones, grapefruit flavors which have potent anti-insect activity, particularly toward termites and hemophagous insects. We raised \$100,000, half of which was paid to LSU for patent expenses, and half of which was used for preliminary chemical engineering of a new synthesis method we patented through LSU. We have formed contacts with a Japanese company for potential veterinary uses for fleas and for mosquito repellants in humans to replace the major product DEET, which has some major side effects. We are working with some Louisiana companies to do the chemical engineering of the synthesis. The company was not able to raise additional capital after the stock market crash of 2008.

TumorEnd, LLC, located in Suite 246, Louisiana Emerging Technology Center, was founded in 2009, by RAL, with a New Orleans business partner Armand Alciatore to license CM101, an anti-angiogenesis antitumor technology from Vanderbilt University for the purpose of human tumor therapy and Veterinary uses. TumorEnd conducted a successful Canine safety trial on CM101 at the LSU College of Veterinary Medicine under Prof. Rhett Stout. TumorEnd is negotiating with a Veterinary Pharmaceutical company for a partnership or license to develop CM101 for Dog Tumors. TumorEnd formed a partnership to develop a humanized murine antibody against HP59, a receptor for CM101. Tumorend was awarded a Phase I SBIR from the NCI for \$150,000 for 6 months, in August, 2012 to study the Structure-Activity Relationship of CM101 to HP59 plus a \$60,000 State Match. The State of Louisiana had previously awarded a \$2500 Phase 0 SBIR to prepare other proposals for the August 2012 Deadline. TumorEnd submitted a Human Clinical Trial SBIR, August, 2012, in partnership with UT Southwestern Medical School in Dallas, Texas, to the NCI, and has established a contract with a cGMP manufacturer in Lincoln, Neb. TumorEnd submitted an SBIR Clinical Trial in Dogs with severe spinal cord injury to NIH in Partnership with North Carolina State University Veterinary College. Professor Khushi L Matta moved his entire laboratory from Roswell Park Memorial Cancer Research Center to TumorEnd's facility April 2012, and transferred \$112,000 in NIH grant support. Professor Matta has submitted 2 SBIR proposals for his work on cancer biomarkers. We have established 3 new high tech jobs for this new business in Louisiana. In September, 2013, TumorEnd was awarded another SBIR on inflammatory inhibitor compounds for \$150,000 plus \$60,000 State Matching Funds.

TumorVet, LLC, was founded in 2010 for veterinary applications of CM101 for which we are organizing canine clinical trials with the LSU Veterinary college in a canine tumor application, and are in process of an AIND for dog cancer. TumorVet completed a dog safety trial at the LSUVC.

Consulting, Boards:

Agratech, Inc., Princeton, New Jersey: Member, Board of Directors, Chairman of Scientific Advisory Board, co-wrote Business Plan, 2000-2002.

International Medical Innovations, IMMI, Inc., Birmingham, AL: Chairman of Scientific Advisory Board, Member, Board of Directors. 2001-2007

Royal Bank Capital Corporation, Toronto, Canada: 1996, consultant for this Toronto, Canada-based venture capital group, performing diligence on a Toronto, Ontario biotechnology company Glycodesign, Inc., for second stage funding. (see Ventures West, below).

Phage Therapeutics, Inc., Bothell, WA Consultant and member of the Scientific Advisory Board to this new startup company in Bothell, Washington, working 2 months in their facility, Summer, 1997.

Demeter, Inc. Scientific Advisory board, 2000-2003.

Ventures West, Inc. , Vancouver, BC. In 1997, RAL worked as a consultant for Ventures West, performing diligence on a Toronto, Ontario biotechnology company Glycodesign and its merger with a London, Ontario Corporation for third stage funding. Glycodesign went public in 2002 for \$132M Canadian.

Schering-Plough, Inc., Memphis, TN, OTC Division – Consulting regarding fungal diagnostics for topical skin infections. May, 2006.

International Medical Innovations: Scientific Advisory board, 1998-2007. Birmingham, AL.

Glycon, LLC: Partner and Scientific advisor, 2010-present.