Curriculum Vitae – Xi Chen

### A. CONTACT INFORMATION

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### B. EDUCATION AND TRAINING

**B.S. in Chemistry:** 1994, Xiamen University, Xiamen, Fujian, China.

**Ph.D. in Chemistry:** 2000, Wayne State University, Detroit, MI. Bio/Organic Chemistry

Dissertation title: 1,3-Galactosyltransferase and -Gal epitope mediated cancer immunotherapy.

(**Advisor:** Dr. Peng G. Wang)

**Postdoctoral Fellow:** May-Dec., 2000, Wayne State University, Detroit, MI.

(**Advisor:** Dr. Peng G. Wang)

### C. PROFESSIONAL EXPERIENCES

1. **7/2011-present,** Professor of Chemistry, University of California-Davis
2. **7/2008-06/2011,** Associate Professor of Chemistry, University of California-Davis
3. **8/2003-6/2008,** Assistant Professor of Chemistry, University of California - Davis
4. **1/2002-7/2003,** Scientist II, Neose Technologies, Inc.
5. **1/2001-1/2002,** Scientist I, Neose Technologies, Inc.

### D. HONORS AND AWARDS

2013 Carbohydrate Research Award for Creativity in Carbohydrate Chemistry 2013

2012 American Chemical Society Carbohydrate Division Horace S. Isbell Award

2011 American Chemical Society - Sociedade Brasileira de Quimica Young Talents in Science Award

2011 Dow Lecturer, University of Minnesota

2009 UC-Davis Chancellor’s Fellow

2009 Camille Dreyfus Teacher-Scholar Award

2009 Invited speaker, 15th Annual Symposium German-American Kavli Frontiers of Science

2008 Alfred P. Sloan Research Fellow

2008 Thieme Chemistry Journals Award

2008 ACS Division of Carbohydrate Chemistry Young Investigator Fellowship Award

2007 Chinese-American Chemistry & Chemical Biology Professor Association (CAPA) Distinguished Junior Faculty Award

2006 Beckman Young Investigator Award

2006 NSF CAREER Award

2000 Travel award for 5th Annual Conference of the Society for Glycobiology

1994 Excellent Graduate

1993 Jingxiong Fellowship

**E. PROFESSIONAL SOCIETY MEMBERSHIPS:**

2000–present American Society for Biochemistry and Molecular Biology

2000–present American Chemical Society

2000–present American Association for the Advancement of Science

2002–present Society for Glycobiology

2004–present Glycobiology Research and Training Center

2005–present Chinese-American Chemistry & Chemical Biology Professor Association (CAPA)

2006–present Board member, Chinese-American Chemistry and Chemical Biology Professors Association (CAPA)

2009–present Journal Editor, Trends in Carbohydrate Research

2009–present Website master for American Chemical Society Division of Carbohydrate Chemistry

2010–present Chinese Chemical Society

2010–2012 Chinese-American Chemistry and Chemical Biology Professors Association (CAPA) Director

2012–present Chinese-American Chemistry and Chemical Biology Professors Association (CAPA) Communication Director

2012-present Journal Editor, Carbohydrate Research

F. PEER-REVIEWED PUBLICATIONS (IN CHRONOLOGICAL ORDER)

1. Fang, J.; Li, J.; **Chen, X.;** Zhang, Y.; Wang, J.; Guo, Z.; Zhang, W.; Yu, L.; Brew, K.; Wang, P. G. Highly efficient chemoenzymatic synthesis of -galactosyl epitopes with a recombinant (1,3)-galactosyltransferase. *J. Am. Chem. Soc.* **1998,** *120,* 6635–6638.
2. **Chen, X.**; Andreana, P. R.; Wang, P. G. Carbohydrates in transplantation. *Curr. Opin. Chem. Biol.* **1999,** *3,* 650–658. PMID: 10600719.
3. **Chen, X.**; Kowal, P.; Hamad, S.; Fan, H.; Wang, P. G. Cloning, expression and characterization of a UDP-galactose 4-epimerase from *E. coli*. *Biotech. Lett.* **1999,** *21,* 1131–1135.
4. Wang, J.; **Chen, X.**; Zhang, W.; Zacharek, S.; Chen, Y.; Wang, P. G. Enhanced inhibition of human anti-Gal antibody binding to mammalian cells by synthetic -Gal epitope polymers*. J. Am. Chem. Soc.* **1999,** *121,* 8174–8181.
5. Fang, J.; **Chen, X.;** Zhang, W.; Wang, J.; Andreana, P.; Wang, P. G. A unique chemoenzymatic synthesis of -Gal epitope derivatives containing free amino groups: efficient separation and further manipulation. *J. Org. Chem.* **1999,** *64,* 4089–4094.
6. Li, J.; Zacharek, S.; **Chen, X.;** Wang, J.; Zhang, W.; Janczuk, A.; Wang, P. G. Bacteria targeted by human natural antibodies using -Gal conjugated receptor-specific glycopolymers. *Bioorgan. Med. Chem.* **1999,** *7,* 1540–1558. PMID: 10482447.

7. Janczuk, A.; Li, J.; Zhang, W.; **Chen, X.;** Chen, Y.; Fang, J.; Wang, J.; Wang, P. G. -Gal oligosaccharides: chemistry and potential biomedical application. *Curr. Med. Chem.* **1999,** *6,* 155–164. PMID: 10189229.

1. Zhang, W.; Xie, W.; Wang, J.; **Chen, X.**; Fang, J.; Chen, Y.; Li, J.; Yu, L.; Chen, D.; Wang, P. G. Recent progress in glycochemistry and green chemistry. *Curr. Org. Chem.* **1999,** *3,* 241–267.
2. **Chen, X.**; Liu, Z.; Wang, J.; Fang, J.; Fan, H.; Wang, P. G. Changing the donor cofactor of 1,3galactosyltransferase by fusion with UDP-Gal 4-epimerase: more efficient biocatalysis for synthesis of -Gal epitopes. *J. Biol. Chem.* **2000,** *275*, 31594–31600. PMID: 10913140.
3. **Chen, X.**; Zhang, W.; Wang J.; Fang, J.; Wang, P. G. Production of -Gal epitopes by combined UDP-galactose 4-epimerase and 1,3-galactosyltransferase recombinant whole cells. *Biotech. Prog.* **2000,** *16*, 595–599. PMID: 10933834.
4. **Chen, X.**; Kowal, P.; Wang, P. G. Large-scale biosynthesis of oligosaccharides. *Curr. Opin. Drug Discovery & Development* **2000,** *3*, 756–763.
5. Fang, J.; **Chen, X.;** Zhang, W.; Janczuk, A.; Wang, P. G. Synthesis of -Gal epitope derivatives with a galactosyltransferase-epimerase fusion enzyme. *Carbohydr. Res.* **2000,** *329*, 873–878. PMID: 11125830.
6. Xian, M.; Wang, K.; Chen, X.; Hou, Y.; McGill, A.; **Chen, X.**; Zhou, B.; Zhang, Z.; Cheng, J.; Wang, P. G. Inhibition of protein tyrosine phosphatases by low-molecular-weight S-nitrosothiols and S-nitrosylated human serum albumin. *Biochem. Biophys. Res. Commun.* **2000,** *268,* 310–314. PMID: 10679200.
7. **Chen, X.**; Fang, J.; Zhang, J.; Liu, Z.; Shao, J.; Kowal, P.; Andreana, P.; Wang, P. G. Sugar nucleotide bead (superbead): a versatile tool for practical synthesis of oligosaccharides. *J. Am. Chem. Soc.* **2001,** *123*, 2081–2082. PMID: 11456841.
8. **Chen, X.**; Zhang, J.; Kowal, P.; Liu, Z.; Andreana, P. R.; Lu, Y.; Wang, P. G. Transferring a biosynthetic cycle into a productive *E. coli* strain: large-scale synthesis of galactosides. *J. Am. Chem. Soc.* **2001**, *123*, 8866–8867. PMID: 11535100.
9. Chen, Y.-S.; Zhang, W.; **Chen, X.;** Wang, J.-Q.; Wang, P. G. -Gal-conjugated anti-rhinovirus agents: chemo-enzymatic syntheses and testing of anti-Gal binding. *J. Chem. Soc., Perkin Trans.* *1*, **2001**, *14*, 1716–1722.
10. Kowal, P.; **Chen, X.;** Wang, P. G. Microbial glycosyltransferases. In: *Glycochemistry: Principles, Synthesis and Applications.* (Editors: Wang, P. G., Bertozzi, C. R.), Marcel Dekker, Inc., New York, NY. **2001**, pp. 625–640.
11. Zhang, J.; Wu, B.; Liu, Z.; Kowal, P.; **Chen, X.**; Shao, J.; Wang, P. G. Large-scale synthesis of carbohydrates for pharmaceutical development. *Curr. Org. Chem.* **2001**, *5*, 1169–1176.
12. **Chen, X.**; Liu, Z.; Zhang, W.; Fang, J.; Andreana, P. R.; Wang, P. G. Large-scale synthesis of carbohydrate through biotechnology: Production of -Gal epitopes by recombinant *E. coli* “superbug”. *ChemBioChem.* **2002**, *3*, 47–53. PMID: 17590953.
13. Liu, Z.; Zhang, J.; **Chen, X.**; Wang, P. G. Combined biosynthetic pathway for de novo production of UDP-galactose: catalyzed with multiple enzymes immobilized on agarose beads. *ChemBioChem* **2002**, *3*, 348–355. PMID: 11933236.
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15. Nahalka, J.; Liu, Z.; **Chen, X.**; Wang, P. G. Superbeads: immobilization in “Sweet” chemistry. *Chemistry* **2003**, *9*, 372–377. PMID: 12532285.
16. **Chen, X.**; Wu, B.; Wang, P. G. Glucuronides in anti-cancer therapy. *Curr. Med. Chem.-Anti-Cancer Agents* **2003**, *3*, 139–150. PMID: 12678908.

24. Zhang, J.; Kowal, P.; **Chen, X.**; Wang, P. G. Large-scale synthesis of globotriose derivatives through recombinant *E. coli*. *Org. Biomol. Chem.* **2003**, *1*, 3048–3053. PMID: 14518127.

25. Zhang, J.; **Chen, X.**; Shao, J.; Liu, Z.; Kowal, P.; Lu, Y.; Wang, P. G. Synthesis of galactose-containing oligosaccharides through superbeads and superbug approaches; substrate recognition along different biosynthetic pathways. *Meth. Enzymol.* **2003**, *362*, 106–124. PMID: 12968360.

26. Saribas, A. S.; Mobasseri, A.; Pristatsky, P.; **Chen, X.**; Barthelson, R.; Hakes, D.; Wang, J. Production of *N*-sulfated polysaccharides using yeast expressed *N*-deacetylase/*N*-sulfotransferase-1 (NDST-1). *Glycobiology*, **2004**, *14*, 1217–1228. PMID: 15253930.

27. Yu, H.; Yu, H.; Karpel, R.; **\*Chen, X.** Chemoenzymatic synthesis of CMP-sialic acid derivatives by a one-pot two-enzyme system: comparison of substrate flexibility of three microbial CMP-sialic acid synthetase. *Bioorg. Med. Chem.* **2004**, *12*, 6427–6435. PMID: 15556760.

28. Yu, H.; Chokhawala, H.; Karpel, R.; Yu, H.; Wu, B.; Zhang, J.; Zhang, Y.; Jia, Q.; **\*Chen, X.** A multifunctional *Pasteurella multocida* sialyltransferase: a powerful tool for the synthesis of sialoside libraries. *J. Am. Chem. Soc.* **2005**, *127*, 17618–17619. PMID: 16351087.

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31. Yu, H.; Huang, S.; Chokhawala, H.; Sun, M.; Zheng, H.; **\*Chen X.** Highly efficient chemoenzymatic synthesis of naturally occurring and non-natural -2,6-linked sialosides: a *P. damsela* -2,6-sialyltransferase with extremely flexible donor substrate specificity. *Angew. Chem. Int. Ed.* **2006**, *45*, 3938–3944. PMID: 16721893. **PMCID:** **PMC2728590**

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2. Yu, H.; Chokhawala, H.; Huang, S.; **\*Chen X.** One-pot three-enzyme chemoenzymatic approach to the synthesis of sialosides containing natural and non-natural functionalities. *Nat. Protoc*. **2006**, *1*, 2485–2492. PMID: 17406495. **PMCID: PMC2586341**
3. Chokhawala, H. A.; **\*Chen X.** Chemical aspects (scope and limitations) A: Enzymatic approaches to O-glycoside introduction: Glycosyltransferases. In *Comprehensive Glycoscience, from Chemistry to Systems Biology* (J. P. Kamerling, Ed.) Subject Editors: Geert-Jan Boons, YC Lee, Akemi Suzuki, Naoyuki Taniguchi, and Alphons G. J. Voragen. Elsevier, Oxford, UK, **2007**, *1*, 415–451.
4. Chokhawala, H.; Yu, H.; **\*Chen X.** High-throughput substrate specificity studies of sialidases using chemoenzymatically synthesized sialoside libraries. *ChemBioChem* **2007**, *8*, 194–201. PMID: 17195254. **PMCID: PMC2610223**
5. Huang, S.; Yu, H.; **\*Chen, X.** Disaccharides as sialic acid aldolase substrates: synthesis of disaccharides containing a sialic acid at the reducing end. *Angew. Chem. Int. Ed.* **2007**, *5*, 2249–2253. PMID: 17309109.
6. Yu, H.; **\*Chen, X.** Carbohydrate post-glycosylational modifications. *Org. Biomol. Chem. (Emerging Area Article)* Featured as cover picture, **2007**, *5*, 865–872. PMID: 17340000. **PMICD:** **PMC2769254.** DOI: 10.1039/b700034.
7. Ni, L.; Chokhawala, H. A.; Cao, H.; Henning, R.; Ng, L.; Huang, S.; Yu, H.; **\*Chen, X.**; \*Fisher, A. J. Crystal structures of a *Pasteurella multocida* sialyltransferase complexes with acceptor and donor analogs reveal substrate binding sites and catalytic mechanism. *Biochemistry* **2007**, *46*, 6288–6298. PMID: 17487984.
8. Yu, H.; Chokhawala, H. A.; Varki, A.; **\*Chen, X.** Efficient chemoenzymatic synthesis of biotinylated human serum albumin-sialoglycoside conjugates containing *O*-acetylated sialic acids. *Org. Biomol. Chem.* **2007**, 5, 2458–2463. PMID: 17637967. PMC2586643. **PMCID: PMC2769491**
9. Li, Y.; Sun, M.; Huang, S.; Yu, H.; Chokhawala, H. A.; Thon, V.; **\*Chen, X.** The *Hd0053* gene of *Haemophilus ducreyi* encodes an 2,3-sialyltransferase. *Biochem. Biophys. Res. Commun.* **2007**, *361*, 555–560. PMID: 17662691. **PMCID: PMC2084346**
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11. Chokhawala, H. A.; Cao, H.; Yu, H.; **\*Chen, X.** Enzymatic synthesis of fluorinated mechanistic probes for sialidases and sialyltransferases. *J. Am. Chem. Soc.* **2007**, *129*, 10630–10631. PMID: 17696347.
12. Muthana, S.; Yu, H.; Huang, S.; **\*Chen, X.** Chemoenzymatic synthesis of size-defined polysaccharides by sialyltransferase-catalyzed block transfer of oligosaccharides. *J. Am. Chem. Soc.* **2007**, 129, 11918–11919. PMID: 17845050.
13. Yu, H.; Chokhawala, H. A.; Huang, S.; **\*Chen, X.** Chemoenzymatic synthesis of sialosides and their applications. In *Chemical Glycobiology* ACS Symposium series 990, Chen, X.; Halcomb, R.; Wang, P. G. Eds. **2008**, Oxford University Press, Pages 96-122.
14. Sun, M.; Li, Y.; Chokhawala, H. A.; Henning, R.; **\*Chen, X.** N-terminal 112 amino acid residues are not required for the sialyltransferase activity of *Photobacterium damsela* 2,6-sialyltransferase. *Biotechnol. Lett.* **2008**, 30, 671–676. PMID: 17989925. **PMCID: PMC2598773**
15. Linman, M. J.; Taylor, J. D.; Yu, H.; **Chen, X.**; \*Cheng, Q. Surface Plasmon Resonance study of protein-carbohydrate interactions using biotinylated sialosides. *Anal. Chem.* **2008**, *80*, 4007–4013. PMID: 18461973. **PMCID: PMC2586005**
16. Li, Y.; Yu, H.; Cao, H.; Lau, K.; Muthana, S.; Tiwari, V. K.; Son, B.; **\*Chen, X.** *Pasteurella multocida* sialic acid aldolase: a promising biocatalyst. *Appl. Microbiol. Biotech.* **2008**, *79*, 963–970. PMID: 18521592. **PMCID: PMC2588431**
17. Wang, Z.; Gilbert, M.; Eguchi, H.; Yu, H.; Cheng, J.; Muthana, S.; Zhou, L.; Wang, P. G.; **Chen, X.**; \*Huang, X. Chemoenzymatic syntheses of tumor-associated carbohydrate antigen Globo-H and stage-specific embryonic antigen 4. *Adv. Synth. Catal.* **2008**, *350*, 1717–1728. **PMCID: PMC2842016**
18. Cheng, J.; Yu, H.; Lau, K.; Huang, S.; Chokhawala, H. A.; Li, Y.; Tiwari, V. K.; **\*Chen, X.** Multifunctionality of *Campylobacter jejuni* sialyltransferase CstII: Characterization of GD3/GT3 oligosaccharide synthase, GD3 oligosaccharide sialidase, and trans-sialidase activities. *Glycobiology* **2008**, *18*, 686–697. PMID: 18509108. doi:10.1093/glycob/cwn047 **PMCID: PMC2588429**
19. Chokhawala, H. A.; Huang, S.; Lau, K.; Yu, H.; Cheng, J.; Thon, V.; Hurtado-Ziola, N.; Guerrero, J. A.; Varki, A.; **\*Chen, X.** Combinatorial chemoenzymatic synthesis and high-throughput screening of sialosides. *ACS Chem. Biol.* **2008**, *3*, 567–576. PMID: 18729452. **PMCID: PMC2588434**.
20. Padler-Karavani, V.; Yu, H.; Cao, H.; Chokhawala, H. A.; Karp, F.; **Chen**, **X.**; Varki, N.; \*Varki, A. Diversity in specificity, abundance and composition of anti-Neu5Gc antibodies in normal humans: Potential implications for disease. *Glycobiology* **2008**, *18*, 818–830. PMID: 18669916. **PMCID:** **PMC2586336**.
21. Cao, H.; Huang, S.; Cheng, J.; Li, Y.; Muthana, S.; Son, B.; **\*Chen, X.** Chemical preparation of sialyl Lewis x using an enzymatically synthesized sialoside building block. *Carbohydr. Res.* **2008**, *343*, 2863–2869. PMID: 18639240. **PMCID:** **PMC2783551**.
22. \*Byres, E.; \*Paton, A. W.; Paton, J. C.; Smith, D. F.; Lofling, J. C.; Wilce, M. C. J.; Chong, D. C.; Talbot, U. M.; Yu, H.; Huang, S.; **Chen, X.**; Varki, N. M.; Varki, A.; Rossjohn, J.; Beddoe, T. Incorporation of a non-human glycan mediates human susceptibility to a bacterial toxin. *Nature* **2008**, *456*, 648–652. PMID: 18971931. **PMCID:** **PMC2723748**.
23. Yu, H.; **\*Chen X.** Enzymatic synthesis of carbohydrate-containing biomolecules. In *Wiley Encyclopedia of Chemical Biology*. Chief Advisor: Tadhag P. Begley, John Wiley & Sons, Inc. NJ, Jan. **2009**. ISBN: 978-0-471-75477-0, http://www.wiley.com/WileyCDA/WileyTitle/productCd-0471754773,descCd-description.html
24. Wong, J. H.; Sahni, U.; Li, Y.; **Chen, X.**; \*Gervay-Hague, J. Synthesis of sulfone-based nucleotide isosteres: identification of CMP-sialic acid synthetase inhibitors. *Org. Biomol. Chem.* **2009**, *7*, 27–29. PMID: 19081938.
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26. Yi, W.; Liu, X.; Li, Y.; Li, J.; Xia, C.; Zhou, G.; Zhang, W.; **Chen, X.**; \*Wang, P.G. Remodeling bacterial polysaccharides by metabolic pathway engineering. *Proc. Natl. Acad. Sci. U.S.A.* **2009**, *106*, 4207–4212. PMID: 19251666. **PMCID:** **PMC2657399**. <http://www.pnas.org/content/106/11/4207.full.pdf+html> News <http://www.genengnews.com/news/bnitem.aspx?name=50093426>
27. Muthana, S.; Yu, H.; Cao, H.; Cheng, J.; **\*Chen, X.** Chemoenzymatic synthesis of a new class of macrocyclic oligosaccharides. *J. Org. Chem.* **2009**, *74*, 2928–2936. Featured article. PMID: 19296596. DOI: 10.1021/jo802785.
28. Linman, M. J.; Yu, H.; **Chen, X.**; \*Cheng, Q. Fabrication and characterization of a sialoside-based carbohydrate microarray biointerface for protein binding analysis with surface Plasmon resonance imaging. *ACS Appl. Mater. Interfaces* **2009**, *1*, 1755–1762. DOI: 10.1021/am900290g.
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30. Muthana, S.; Cao, H.; **\*Chen, X.** Recent progress in chemical and chemoenzymatic synthesis of carbohydrates. Invited review. *Curr. Opin. Chem. Biol*.**2009**, *13*, 573–581. PMID: 19833544. **PMCID: PMC3097241.** DOI: 10.1016/j.cbpa.2009.09.013.
31. Cao, H.; Li, Y.; Lau, K. ; Muthana, S. ; Yu, H.; Cheng, J.; Chokhawala, H. A.; Sugiarto, G.; Zhang, L.; **\*Chen, X.** Sialidase substrate specificity studies using chemoenzymatically synthesized sialosides containing C5-modified sialic acids. *Org. Biomol. Chem.* **2009**, *7*, 5137–5145. PMID: 20024109. DOI: 10.1039/B916305K
32. Pham, T.; Gregg, C.; Karp, F.; Chow, R.; Padler-Karavani, V.; Cao, H.; **Chen, X.**; Witztum, J. L.; Varki, N. M.; \*Varki, A. Evidence for a novel human-specific xeno-auto-antibody response against vascular endothelium. *Blood* **2009**, *114*, 5225–5235. PMID: 19828701. **PMCID: PMC2792214.** DOI 10.1182/blood-2009-05-220400
33. Yu, H.; Cheng, J.; Ding, L.; Khedri, Z.; Chen, Y.; Chin, S.; Lau, K.; Tiwari, V. K., **\*Chen, X.** Chemoenzymatic synthesis of GD3 oligosaccharides and other disialyl glycans containing natural and non-natural sialic acids. *J. Am. Chem. Soc.* **2009**, 131, 18467–18477. PMID: 19947630. **PMCID: PMC2811049. DOI**: 10.1021/ja907750r
34. Cheng, J.; Huang, S.; Yu, H.; Li, Y.; Lau, K.; **\*Chen, X.** Trans-sialidase activity of *Photobacterium damsela* 2,6-sialyltransferase and its application in the synthesis of sialosides. *Glycobiology* **2010**, *20*, 260–268. PMID: 19880425. **PMCID: PMC2800248.** DOI:10.1093/glycob/CWP172
35. **\*Chen, X.**; \*Varki, A. Recent advances in sialic acid biology and chemistry. *ACS Chem. Biol.* **2010**, 5, 163–176. PMID: 20020717. **PMCID:** **PMC2825284.** DOI: 10.1021/cb900266r
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37. Zhang, L.; Lau, K.; Cheng, J.; Yu, H.; Li, Y.; Sugiarto, G.; Huang, S.; Ding, L.; Thon, V.; Wang, P. G.; **\*Chen, X.** *Helicobacter hepaticus* Hh0072 gene encodes a novel 1–3-fucosyltransferase belonging to CAZy GT11 family. *Glycobiology* **2010**, *20*, 1077–1088. PMID: 20466652. **PMCID: PMC2948817.**
38. Lau, K.; Thon, V.; Yu, H.; Ding, L.; Chen, Y.; Muthana, M. M.; Wong, D.; Huang, R.; **\*Chen, X.** Highly efficient chemoenzymatic synthesis of 1–4-linked galactosides with promiscuous bacterial 1–4-galactosyltransferases. *Chem Commun.* *(Camb)* **2010**, *46*, 6066–6068. PMID: 20625591. **PMCID: PMC3114949.** DOI: 10.1039/c0cc01381a.
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