

## PolyMedix Bibliography – September 2010

### Antimicrobial

Selected scientific publications and presentations at scientific conferences related to PMX-30063 and PolyMedix's antibiotic programs include:

McAllister, R.E. "An Approach to New Antibiotics for Avoiding Resistance: PMX-30063", 8<sup>th</sup> World Congress on Trauma, Shock, Inflammation and Sepsis – TSIS 2010. Munich, Germany, March 11, 2010.

Tew, G., Scott, R.W., Klein, M., DeGrado, W. "De Novo Design of Antimicrobial Polymers, Foldamers, and Small Molecules: From Discovery to Practical Applications". Accounts of Chemical Research, 30-39 January 2010.

McAllister, R.E., Korczak, B., Scott, R.W. "Human Safety and Pharmacokinetics of PMX-30063, A Small Non-peptidic Mimetic of the Host Defense Proteins". Poster presentation at the American Society for Microbiology's (ASM) Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC), San Francisco, CA, September 15, 2009.

Pulse, M.E., Weiss, W.J., Nguyen, P., Piece, J., Simecka, J., Scott, R.W. "Efficacy of PMX-30063 in Experimental Staphylococcal Skin and Skin Structure Infection Models". Poster presentation at the American Society for Microbiology's (ASM) Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC), San Francisco, CA, September 15, 2009.

Scott, R.W., Clements, D., O'Leary, A. "Pharmacokinetic-Pharmacodynamic Relationships for PMX-30063 in the Mouse Thigh Burden Model". Poster presentation at the American Society for Microbiology's (ASM) Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC), San Francisco, CA, September 15, 2009.

Scott, R.W., Liu, D., Clemens D., Selbovitz M, Miller D., DeGrado W.F. "Developing new antibiotic approaches to controlling MDR/XDR TB in HIV patients on HAART". 5<sup>th</sup> International AIDS Society Conference, Cape Town, South Africa, July 21, 2009.

Scott R.W., Mensa B., Clemens D., Caputo G., DeGrado W. "Antimicrobial Systemic Antibiotics: Small Molecule Mimics of Host Defense Proteins." 109<sup>th</sup> General Meeting of the American Society of Microbiology, Baltimore, Maryland, May 19, 2009.

Scott, R.W, Miller D., Selbovitz M., Mensa B., Clements D., DeGrado W.F. "Selected antimicrobial compounds against *M. tuberculosis* show significant activity *in vitro* for more effective treatment in HIV co-infected patients." 22nd International Conference on Antiviral Research (ICAR), Miami, Florida, May 5, 2009.

Scott R.W., Miller D, Selbovitz M, Gibbs J, Zive J, Norwood C. "Beyond INH: New classes of drug development for the treatment of multi-drug resistant tuberculosis (MDR-TB) and extensively drug resistant tuberculosis (XDR-TB) infections and global vulnerabilities of HIV+ drug users is a determining consideration for the development of defensin mimetics." 5<sup>th</sup> European Conference on Clinical and Social Research on AIDS and Drugs, Vilnius, Lithuania, April 28-30, 2009.

Choi, S., Isaacs, A., Clements, D., Liu, D., Kim, H., Scott, R., Winkler, J., DeGrado, W.F. "De Novo Design and In Vivo Activity of Conformationally Restrained Antimicrobial Arylamide Foldamers". PNAS, April 28, 2009, 106: 6968-6973.

Greenbaum D, Harbut M, DeGrado B, Bergman L, Scott R. "Small Molecule Mimetics of Antimicrobial Peptides as Antimalarials." Malaria Keystone Conference: Drug Discovery for Protozoan Parasites, Breckenridge, Colorado, March 23, 2009.

Korczak, B. "A Novel I.V. Antibacterial Agent for Hospital Acquired Infections," SMi Superbugs & Superdrugs Conference - A Focus on Antibacterials, London, England, March 18, 2009

McAllister, E. "Development of a New Antibacterial Class." Healthtech Drug Development Conference: The Challenge of Antibacterial Drug Development, San Diego, California, March 18, 2009

Scott, R.W. "Nonpeptidic Mimics Of Host Defense Proteins: Development As IV Antimicrobial Agents." 2009 Gordon Conference on Antimicrobial Peptides: Understanding Health And Disease Through Antimicrobial Host Defense Peptides. Ventura, California, March 4, 2009.

Scott, R.W. "Nonpeptidic Mimics of Host Defense Proteins: Activity against Category A Biopathogens". American Society of Microbiology 7<sup>th</sup> Annual Biodefense and Emerging Diseases Research Meeting, Baltimore, Maryland, February 24, 2009.

S. Colak, C. F. Nelson, K. Nüsslein, G. N. Tew, "Hydrophilic Modifications on an Amphiphilic Polynorbornene and the Effects on its Hemolytic and Antibacterial Activity," *Biomacromolecules*, 10, 353-359, (2009).

A. E. Madkour, J. M. Dabkowski, K. Nüsslein, G. N. Tew, "Fast Disinfecting Antimicrobial Surfaces," *Langmuir*, **25**, 1060-1067, (2009).

L. Yang, V. D. Gordon, D. R. Trinkle, N. W. Schmidt, M. A. Davis, C. DeVries, A. Som, J. E. Cronan, Jr., G. N. Tew, G. C. L. Wong, "Mechanism of a Prototypical Synthetic Membrane-Active Antimicrobial: Efficient Hole-Punching via Interaction with Negative Intrinsic Curvature Lipids," *Proc. Natl. Acad. Sci.*, **105**, 20595-20600, (2008).

Scott R.W., DeGrado W.F., and Tew G.N. 2008. "De novo designed synthetic mimics of antimicrobial peptides". *Current Opinions in Biotechnology*, 19: 620-627.

Scott, R.W., Liu, D., Clements, D., Selbovitz, M., Miller, D., Cruz, G., Mensa, B., and DeGrado, W.F. "Novel Antimicrobial Molecules for Treatment of *Mycobacterium tuberculosis*". Keystone Symposia Global Health Series, Keystone, Colorado, January 28, 2009.

Scott, R.W., Liu, D., Clements, D., Selbovitz, M., Miller, D., Cruz, G., Mensa, B., and DeGrado, W.F. "Antimicrobial Molecules for Treatment of Multi-Drug Resistant (MDR) and Extensively Drug Resistant (XDR) Strains of *Mycobacterium tuberculosis*". HIV DART Conference, Puerto Rico, December 10, 2008.

Scott, R.W., Korczak, B, Clements, D.J., Xu, Y., Liu, D. "In Vivo Efficacy and Safety of a Novel Host Defense Protein Mimetic, PMX30063: a Candidate IV Agent to Treat Staphylococcal

Infections". Presentation at the American Society for Microbiology's (ASM) Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC), Washington, D.C., October 28, 2008.

G. J. Gabriel, J. A. Maegerlein, C. F. Nelson, J. M. Dabkowski, T. Eren, K. Nüsslein, G. N. Tew, "Comparison of Facially Amphiphilic versus Segregated Monomers in the Design of Antibacterial Copolymers." *Chem. Eur. J.*, **15**, 433-439, (2009).

Scott, R.W., Xu, Y., Liu, D., Clements, D.J., DeGrado, W.F. "In Vitro Antimicrobial Activities of a Novel Host Defense Protein Mimetic, PMX30063, Against Multiple Isolates of Staphylococci with Defined Susceptibility Phenotypes". Presentation at the American Society for Microbiology's (ASM) Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC), Washington, D.C., October 28, 2008.

Greenbaum, D., Scott, R.W., Liu, D., Chandramohanadas, R., Shanmugan, D., DeGrado, W.F. "Small Molecule Mimics of Antimicrobial Peptides as Potential Antimalarials". University of Pennsylvania, Medical School. Platform presentation at the American Society for Microbiology's (ASM) Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC), Washington, D.C., October 27, 2008.

Diamond, D., Park, S., Perlin, D., Yamarthy, R., Felsenstein, S., Scott, R.W. "In vitro activity of novel biomimetic compounds against oral *Candida* strains". University of Medicine and Dentistry of New Jersey. Presentation at the American Society for Microbiology's (ASM) Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC), Washington, D.C., October 27, 2008.

Scott, R.W., Clements, D.J., DeGrado, W.F. "Global Tuberculosis Epidemic and PolyMedix Solutions". Presentation at New Directions In AIDS Treatment Research Policy and Care Symposium, September 26, 2008, New York NY

Scott, R.W., Liu, D., Clements, D.J., Tang, T., Xu, Y., DeGrado, W.F. "Development of Synthetic Mimetics of Host Defense Proteins as Pan- Staphylococcal Antimicrobial Agents". Presentation at GTC BIO Bugs and Drugs Conference, September 22-23, 2008, San Diego CA.

Som, A., Vemparala, S., Ivanov, I. and Tew G.N.. 2008. Synthetic mimics of antimicrobial peptides. *Biopolymers* 90: 83-93.

Gabriel, G.J. and Tew, G.N.. 2008. Conformationally rigid proteomimetics: a case study in designing antimicrobial aryl oligomers. *Org. Biomol. Chem.* 6: 417-423.

H. Weinkauff, B. Brehm-Stecher, 2008. "Wide-Spectrum Biomimetic Antimicrobial Systems", Presentation at American Society of Microbiology 6<sup>th</sup> Annual Biodefense and Emerging Diseases Research Meeting, February 24-27, 2008, Baltimore, MD

Beckloff, N., Laube, D., Castro, T., Furgang, D., Park, S., Perlin, D., Clements, D., Tang, H., Scott, R.W., Tew, G.N. and Diamond, G.. 2007. Activity of an antimicrobial peptide mimetic against planktonic and biofilm cultures of oral pathogens. *Antimicrob. Agents Chemother.* 51: 4125-4132.

Yang, L., Gordon, V.D., Mishra, A., Som, A., Purdy, K.R., Davis, M.A., Tew, G.N. and Wong, G.C.. 2007. Synthetic antimicrobial oligomers induce a composition-dependent topological transition in membranes. *J. Am. Chem. Soc.* 129: 12141-12147.

Gabriel, G.J., Som, A., Madkour, A.E., Eren, T. And Tew, G.N.. 2007. Infectious disease: Connecting innate immunity to biocidal polymers. *Mater. Sci. Eng. R. Rep.* 57: 28-64.

R.W. Scott, D. Liu, D.J. Clements, G.N. Tew, W.F. DeGrado, 2006. "In Vivo Activities of Amphiphilic Biomimetic Compounds", Presentation at the American Society for Microbiology's (ASM) Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC), San Francisco, California, September 30, 2006.

Tang, H., Doerksen, R. J., Jones, T. V., Klein, M. L., and Tew, G. N.. 2006. Biomimetic facially amphiphilic antibacterial oligomers with conformationally stiff backbones. *Chem. Biol.* 13: 427-435.

Nusslein, K., Arnt, L., Rennie, J., Owens, C., and Tew, G.N.. 2006. Broad-spectrum antibacterial activity by a novel abiogenic peptide mimic. *Microbiology* 152: 1913-1918.

Arnt, L., Rennie, J.R., Linser, S., Willumeit, R. and Tew, G.N.. 2006. Membrane activity of biomimetic facially amphiphilic antibiotics. *J. Phys. Chem. B.* 110: 3527-3532.

Tew, G. N., Clements, D., Tang, H., Arnt, L. and Scott, R. W.. 2006. Antimicrobial activity of an abiotic host defense protein mimic. *Biochem. Biophys. Acta.* 1758:1387-1392.

Kuroda, K. and DeGrado, W. F.. 2005. Amphiphilic Polymethacrylate derivatives as antimicrobial agents. *J. Am. Chem. Soc.* 127: 4128-4129.

I.Ivanov, S. Vemparala, V. Pophristic, K. Kuroda, W. F. DeGrado, M. L. Klein, "Characterization of Non-biological Antimicrobial Polymers in Aqueous Solution and at Water-Lipid Interfaces from All Atom Molecular Dynamics", *J. Am. Chem. Soc.*, 2006, 128, 1778.

Tang, H., Doerksen, R. J. and Tew, G. N.. 2005. Synthesis of urea oligomers and their antibacterial activity. *Chem. Commun. (Camb)* 28: 1537-1539.

Ilker, M. F., Nusslein, K., Tew, G. N. and Coughlin, E. B.. 2004. Tuning the hemolytic and antibacterial activities of amphiphilic polynorbornene derivatives. *J. Am. Chem. Soc.* 126: 15870-15875.

Liu, D., Choi, S., Chen, B., Doerksen, R. J., Clements, D. J., Winkler, J. D., Klein, M. D. and DeGrado, W. F.. 2004. Nontoxic membrane-active antimicrobial arylamide oligomers. *Angew. Chem. Int. Ed.* 43: 1158-1158.

Arnt, L., Nusslein, K. and Tew, G. N.. 2004. Nonhemolytic abiogenic polymers as antimicrobial peptide mimics. *J. Polymer Sci.* 42: 3860-3864.

Arnt, L. and Tew, G. N. 2002. New poly(phenyleneethynylene)s with cationic, facially amphiphilic structures. *J. Am. Chem. Soc.* 124: 7664-7665.

Tew, G. N., Liu, D., Chen, B., Doerksen, R. J., Kaplan, J., Carroll, P. J., Klein, M. L. and DeGrado, W. F.. 2002. De novo design of biomimetic antimicrobial polymers. *Proc. Natl. Acad. Sci. USA* 99: 5110-5114.

Liu, D. and DeGrado, W. F.. 2001. De novo design, synthesis, and characterization of antimicrobial beta-peptides. *J. Am. Chem. Soc.* 123: 7553-7559.

Hamuro, Y., Schneider, J. P., and DeGrado, W. F.. 1999. De novo design of antibacterial beta-peptides. *J. Am. Chem. Soc.* 121: 12200-12201.

Ivanov, I., Vemparala, S., Pophristic, V., Kuroda, K., DeGrado, W. F., McCammon, J. A. and Klein, M. L.. 2006. Characterization of nonbiological antimicrobial polymers in aqueous solution and at water-lipid interphases from all-atom molecular dynamics. *J. Am. Chem. Soc.* 128: 1778-1779.

Pophristic, V., Vemparala, S., Ivanov, I., Liu, Z., Klein, M.L. and DeGrado, W.F.. 2006. Controlling the shape and flexibility of arylamides: a combined ab initio, ab initio molecular dynamics, and classical molecular dynamics study. *J. Phys. Chem. B.* 110: 3517-3526.

Doerksen, R. J., Chen, B., Liu, D., Tew, G. N., DeGrado, W. F. and Klein, M. L.. 2004. Controlling the conformation of arylamides: computational studies of intramolecular hydrogen bonds between amides and ethers or thioethers. *Chemistry* 10: 5008-5016.

Doerksen, R. J., Chen, B. and Klein, M. L.. 2003. Intramolecular hydrogen bonds: ab initio Car-Parrinello simulations of arylamide torsions. *Chem. Phys. Lett.* 380: 150-157.

Yang L, Gordon VD, Mishra A, Som A, Purdy KR, Davis MA, Tew GN, Wong GCL. 2007. Synthetic Antimicrobial Oligomers Induce a Composition-Dependent Topological Transition in Membranes. *J. Am. Chem. Soc.* 129:12141-12147.

## Reviews - Antimicrobial Peptides

Tossi, A., Sandri, L., and Giangaspero, A., 2000. Amphipathic,  $\alpha$ -helical antimicrobial peptides, *Biopoly.* 55: 4-30.

Zasloff, M., Antimicrobial peptides of multicellular organisms, *Nature*, 415, 389-395 (2002).

Beisswenger C. and Bals R. 2005. "Functions of antimicrobial peptides in host defense and immunity". *Curr Protein Pept Sci.* 6:255-264.

## Heptagonist

Selected scientific publications and presentations at scientific conferences related to PMX-60056 and PolyMedix's heptagonist program includes:

Jeske, W., Brubaker A., Liu D., Scott, R., Young T., Hoppensteadt D. "Novel Antagonists for Low Molecular Weight Heparin and Heparin-Like Drugs". American Society of Hematology, New Orleans, LA, December 8, 2009.

Kuziej J, Litinas E, Hoppensteadt D, Liu D, Walenga JM, Fareed J and Jeske W. "Neutralization of Hemorrhagic and Antithrombotic Activities of Heparins by a Novel Salicylamide Derivative." Federation of American Societies for Experimental Biology, April 2009.

Fareed J, Jeske W, Cunanan J, Adiguzel C, Iqbal O and, Hoppensteadt D. "Neutralization of the Anticoagulant and Anti-Xa Effects of Fondaparinux and Idraparinux by a Novel Synthetic Antagonist. Pharmacologic Implications." Federation of American Societies for Experimental Biology, April 2008.

Jeske W, Brubaker A, Liu D, Young T, Hoppensteadt D, Iqbal O, Fareed J, Walenga J, Bakhos M. "Neutralization of Unfractionated Heparin and Low Molecular Weight Heparin by Novel Salicylamide Derivatives." Federation of American Societies for Experimental Biology, April 2008.

Jeske W, Brubaker A, Liu D, Young T, Hoppensteadt D, Iqbal O, Fareed J, Walenga J and Bakhos M. "In Vitro Characterization of the Neutralization of Unfractionated Heparin and Low Molecular Weight Heparin by Novel Salicylamide Derivatives". American Society of Hematology, Atlanta, Georgia. December 9, 2007.

V. Pophristic, S. Vemparala, I. Ivanov, Z. Liu, M. L. Klein, W. F. DeGrado, "Controlling the Shape and Flexibility of Arylamides: A Combined *Ab Initio*, Molecular Dynamics and Classical Molecular Dynamics Study", *J. Phys. Chem. B*, 2006, 110, 3517.

S. Vemparala, V. Pophristic, I. Ivanov, M. L. Klein, "Interaction of Arylamide Polymers with Heparin and Lipid Bilayers", *Biophys. J.*, 2005, 88, 235A.

S. Choi, D. J. Clements, V. Pophristic, I. Ivanov, S. Vemparala, J. S. Bennett, M. L. Klein, J. D. Winkler, W. F. DeGrado, "The Design and Evaluation of Heparin-Binding Foldamers", *Angew. Chem. Int. Ed.*, 2005, 41, 6599.