

## Curriculum Vitae

### Shahriar Mobashery

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Date of Birth: May 17, 1958

#### Education:

University of Southern California, Los Angeles, California  
B.S. Biological Sciences, 1980  
B.S. Chemistry, 1981

University of Chicago, Chicago, Illinois  
Ph.D. Chemistry, 1985

#### Experience:

Predocutorial Research; University of Southern California, Department of Chemical Engineering, Professor T.F. Yen's laboratory, 1979-1981.

University of Chicago, Department of Chemistry, Professor Michael Johnston's laboratory, 1981-1985.

Postdoctoral Research; Rockefeller University, Laboratory of Bioorganic Chemistry and Biochemistry, the late Professor Emil Thomas Kaiser's laboratory, 1986-1988.

Assistant Professor; Department of Chemistry, Wayne State University, 1989-1994.

Associate Professor; Department of Chemistry, Wayne State University, 1994-1997.

Professor; Department of Chemistry, Wayne State University, 1997-2003.

Professor; Departments of Pharmacology and Biochemistry and Molecular Biology, Wayne State University, 2000-2003.

Chair; Division of Biochemistry of the Department of Chemistry, 1996-2000.

Director, Institute for Drug Design, 2000-2003.

Navari Family Professor in Life Sciences; Department of Chemistry and Biochemistry; University of Notre Dame, 2003-present.

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### **Membership in Professional Societies:**

American Chemical Society  
American Association for Advancement of Science  
American Society for Microbiology  
Sigma Xi  
American Society for Biochemistry and Molecular Biology

### **Honors and Awards:**

The Outstanding Senior Recognition Award, University of Southern California, 1980 and 1981  
Sigma Xi Award, University of Southern California, 1981  
The Rockefeller Postdoctoral Fellowship, 1986-1987  
The National Institutes of Health Postdoctoral Fellowship, 1987-1988  
The Jane Coffin Child Postdoctoral Fellowship, 1987 (declined)  
Award of the Lectureship of the Society of Synthetic Organic Chemistry (Japan), 1995  
Career Development Chair Award, WSU, 1996  
Award of Excellence in Teaching, 1997.  
Charles H. Gershenson Distinguished Faculty Fellow, 1999-2001  
Honorary Charter Member of the Argentinian Society for Organic Chemistry, 2003-present.  
Fellow of the American Association for the Advancement of Science (AAAS), elected 2007.  
Astellas USA Foundation Award of the American Chemical Society, 2007.

### **Professional Activities:**

Consultant, Salk Institute Biotechnology/Industrial Associates (SIBIA), 1989-1992, Affymax Corp., 1996-1998, Procter & Gamble Pharmaceuticals, 1997-1998, Aurora Biosciences Corp., 1998-2000, Guilford Pharmaceutical Co., 2000-2002, NewBiotics, Inc., 2000-present, Rigel, Inc., 2003-present. Consultant to law firms 1993-present.  
Editorial Board Member of *Pharmaceutical and Medicinal Chemistry*, 1995-present, *J. Antibiot.*, 1998-2006, *Antimicrob. Agents Chemother.*, 1999-present, *Bioorganic Chemistry*, 2000-present ; *Current Organic Synthesis*, 2002-present, *Lett. Org. Chem.*, 2002-present; *Letters in Drug Design and Discovery*, 2002-present; *Mini Reviews in Organic Chemistry*, 2002-present. *Chemical Biology & Drug Design*, 2006-present. *Open Organic Chemistry Journal*, 2006-present. *Cancer Management and Research*, 2008-present. *Microbial Drug Resistance*, 2009-present.  
Scientific Advisory Board, NewBiotics, Inc. 2000-2003.  
Panel Member, NIH Summit on Development of Infectious Diseases Therapeutics, September 2000.  
Panel Member, NIH Summit on Development of Infectious Diseases Therapeutics, August 2004.  
Section Co-Editor, *Current Opinion in Chemical Biology*, 2003.  
American Cancer Society, Advisory Committee on Biochemistry and Endocrinology (Study Section), 1994-1996, 1999-2000.  
Member, NIH Bioorganic and Natural Products (BNP) Study Section (became the SBC-B Study Section), 2001-2005.  
Ad hoc reviewer for the National Science Foundation, National Institutes of Health, Department of Veterans Affairs, American Chemical Society (Petroleum Research Fund), French Ministry of Research, Swiss National Science Foundation, Israeli Science Foundation, Minnesota Sea Grant Program, Medical Research Council of the United Kingdom, Biotechnology and Biological Sciences Research Council (of the UK) and Engineering Research Council of Canada, Health Research Board of Ireland, Natural Sciences and Engineering Research Council of Canada (NSERC), Research Grants Council (RGC) of Hong Kong, Health

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- Research Borad of Ireland, US-Israel Binational Science Foundation, National Science Foundation of Belgium.
- Member, Site Visit Team for the National Cancer Institute, May 1995.
- Ad hoc reviewer for the following journals (1989-present): *J. Am. Chem. Soc.*, *Proc. Nat. Acad. Sci. U.S.A.*, *Biochemistry*, *Chemistry & Biology*, *Tetrahedron*, *Tetrahedron Lett.*, *Bioorg. Med. Chem.*, *Bioorg. Med. Chem. Lett.*, *J. Med. Chem.*, *J. Biol. Chem.*, *J. Biomol. Struct. Dynam.*, *J. Org. Chem.*, *Proteins: Structure, Function, and Genetics*, *Pharm. Med. Chem.*, *J. Chem. Soc. Chem. Comm.*, *Antimicrob. Agents Chemother*, *Bioorganic Chemistry*, *Arch. Biochem. Biophys*, *Protein Engineering*, *Molecular Medicine Today*, *Organic Prep. Proc. Int.*, *Eur. J. Biochem.*, *Archives of Biochemistry and Biophysics*, *J. Bacteriol.*, *Protein Science*, *Brit. J. Cancer*, *J. Mol. Biol.*, *Medical Principles and Practice*, *J. Mol. Biol.*, *Biochem. Biophys. Acta*, *Org. Lett.*, *Microbiology*, *J. Phys. Chem.*, *Inorgan. Chem.*, *Molec. Micro.*, *ChemBioChem.*, *Structure*, *Biochimica et Biophysica Acta*, *FEMS Micro. Lett.*, *Org. Biomolec. Chem.*, *Biomacromolecules*, *Langmuir*, *ACS Chem. Biol.*, *BBA - Proteins and Proteomics*, *European Journal of Medicinal Chemistry*, *Nature Reviews Drug Discovery*, *Nature Nanotechnology*, *Chemical Biology & Drug Design*, *Trends in Microbiology*, *ACS Journal of Combinatorial Chemistry*, *Int. J. Cancer*, *Eur. J. Med. Chem.*, *J. Infection*, *Perspect. Med. Chem.*, *Applied and Environmental Microbiology*, *Angewandte Chemie* and *J. Antibiot.*
- Chairman, The Enzyme Mechanisms Section of the XII Midwest Enzyme Chemistry Conference, October 1992, Chicago, Illinois
- Chairman, The Enzyme Mechanisms Section of the Second International Symposium on Bioorganic Chemistry, Fukuoka, Japan, June 1993
- Organizer and Chairman, Symposium on "Rational Drug Design and Enzyme Mechanisms", The joint 26th Central Regional/27th Great Lakes Regional ACS meeting, Ann Arbor, Michigan, June 1-3, 1994
- Organizer and Chairman, Symposium on "Recent Developments in Antibacterials and Mechanisms of Resistance", The Central ACS meeting, Midland, Michigan, May 1997
- Organizer, Symposium on "Recent Developments in Antibacterials and Mechanisms of Resistance", Wayne State University, May 1997
- Organizer, XVIII Midwest Enzyme Chemistry Conference, Evanston, Illinois, October 1998.
- Organizer, Symposium of  $\beta$ -Lactamases, the National Meeting of the American Society for Microbiology, Orlando, Illinois, Florida, 2001.
- Who's Who in America, 2002-present.
- Who's Who in the World, 2002-present.
- Who's Who in Science and Engineering, 2003-present.
- Who's Who in Sciences Higher Education (WWSHE), 2004-present.
- Organizing Committee Member, Meeting of the International Union of Biochemistry and Molecular Biology (IUBMB), Toronto, Canada, 2003.
- Advisory Board Member of the Department of Defense Center of Excellence in Breast Cancer at Wayne State University, 2002-2003.
- Co-Editor (with John Richards) for the issue of *Curr. Opin. Chem. Biol.* on Complex Biological Systems (2003).
- Co-Editor (with Steve Brickner) for the issue of *Curr. Opin. Microbiol.* on Antibiotics (2007).
- Organizer, Conference entitled "Novel Antibiotics, Old and New Targets", June 2008.
- Advisory Board Member, Faculty of 1000 Biology, 2008-present.
- Member, NIH Drug Discovery and Resistance (DDR) Study Section, 2009-present.

**Publications:**

1. Mobashery, S.; Johnston, M. A New Approach to the Preparation of N-Carboxy- $\alpha$ -Amino Acid Anhydrides, *J. Org. Chem.* **1985**, *50*, 2200.
2. Mobashery, S.; Lerner, S. A.; Johnston, M. Conscripting  $\beta$ -Lactamase for Use in Drug Delivery. Synthesis and Biological Activity of a Cephalosporin C<sub>10</sub>-Ester of an Antibiotic Dipeptide, *J. Am. Chem. Soc.* **1986**, *108*, 1685.
3. Mobashery, S.; Johnston, M. Reactions of *Escherichia coli* TEM  $\beta$ -Lactamase with Cephalothin and with C<sub>10</sub>-Dipeptidyl Cephalosporin Esters, *J. Biol. Chem.* **1986**, *261*, 7879.
4. Mobashery, S.; Johnston, M. A Novel Approach to Deacylation of Ceph-3-em Esters, *Tetrahedron Lett.* **1986**, *27*, 3333.
5. Mobashery, S.; Johnston, M. Preparation of Ceph-3-em Esters Unaccompanied by  $\Delta^3 \rightarrow \Delta^2$  Isomerization of the Cephalosporin, *J. Org. Chem.* **1986**, *51*, 4723.
6. Mobashery, S.; Johnston, M. Inactivation of Alanine Racemase by  $\beta$ -Chloro-L-Alanine Released Enzymatically from Amino Acid and Peptidyl C<sub>10</sub>-Esters of Deacetylcephalothin, *Biochemistry* **1987**, *26*, 5878.
7. Mobashery, S.; Lerner, S.; Johnston, M. Monitoring  $\beta$ -Lactamase Activity *In Vivo* by <sup>13</sup>C Nuclear Magnetic Resonance Spectroscopy, *Antimicrob. Agents Chemother.* **1988**, *32*, 1196.
8. Mobashery, S.; Kaiser, E. T. Identification of Active Site Amino Acid Residues in the Catalytic Subunit of Bovine Cyclic AMP-Dependent Protein Kinase by Peptide-Based Affinity Inactivators, *Biochemistry* **1988**, *27*, 3691.
9. Radziejewski, C.; Miller, W. T.; Mobashery, S.; Goldberg, A.; Kaiser, E. T. Purification of Recombinant *v-src* Gene-Product from *Saccharomyces Servisiae* and Analysis of Peptidic Substrates to the Enzyme, *Biochemistry* **1989**, *28*, 9047.
10. Mobashery, S.; Ghosh, S.; Tamura, S. Y.; Kaiser, E. T. Design of an Effective Mechanism-Based Inactivator for a Zinc Protease, *Proc. Natl. Acad. Sci. U. S. A.* **1990**, *87*, 578.
11. Mobashery, S.; Doughty, M.; Kaiser, E. T. Inactivation of the Catalytic Subunit of Bovine Cyclic AMP-Dependent Protein Kinase by a Peptide-Based Affinity Inactivator, *Biopolymers* **1990**, *29*, 131.
12. Ghosh, S. S.; Wu, Y. Q.; Mobashery, S. Peptidic Mechanism-Based Inactivators for Carboxypeptidase A, *J. Biol. Chem.* **1991**, *266*, 8759.
13. Wu, Y. Q.; Mobashery, S. Targeting Renal Dipeptidase (Dehydropeptidase I) for Inactivation by Mechanism-Based Inactivators, *J. Med. Chem.* **1991**, *34*, 1914.
14. Goren, Z.; Heeg, M. J.; Mobashery, S. Facile Chloride Substitution of Activated Alcohols by Triphosgene: Application to Cephalosporin Chemistry, *J. Org. Chem.* **1991**, *54*, 7186.
15. Wilder, R.; Mobashery, S. The Use of Triphosgene in Preparation of N-Carboxy- $\alpha$ -Amino Acid Anhydrides, *J. Org. Chem.* **1992**, *57*, 2755.

16. Zafaralla, G.; Mobashery, S. Facilitation of the  $\Delta^2 \rightarrow \Delta^1$  Pyrroline Tautomerization of Carbapenem Antibiotics by the Highly Conserved Arginine-244 of Class A  $\beta$ -Lactamases During the Course of Turnover, *J. Am. Chem. Soc.* **1992**, *114*, 1505.
17. Zafaralla, G.; Manavathu, E. K.; Lerner, S. A.; Mobashery, S. Elucidation of the Role of Arg-244 in the Turnover Processes of Class A  $\beta$ -Lactamases, *Biochemistry* **1992**, *31*, 3847.
18. Ghosh, S. S.; Said-Nejad, O.; Roestamadji, J.; Mobashery, S. The First Mechanism-Based Inactivator for Angiotensin-Converting Enzyme, *J. Med. Chem.* **1992**, *35*, 4175.
19. Imtiaz, U.; Billings, E.; Knox, J. R.; Manavathu, E. K., Lerner, S. A.; Mobashery, S. Inactivation of Class A  $\beta$ -Lactamases by Clavulanic Acid: The Role of Arginine-244 in a Proposed Nonconcerted Sequence of Events, *J. Am. Chem. Soc.* **1993**, *115*, 4435.
20. Zafaralla, G.; Mobashery, S. Evidence for a New Enzyme-Catalyzed Reaction Other Than  $\beta$ -Lactam Hydrolysis in Turnover of a Penem by the TEM-1  $\beta$ -Lactamase, *J. Am. Chem. Soc.* **1993**, *115*, 4962.
21. Levy, O. E.; Taibi, P.; Mobashery, S.; Ghosh, S. S. A Mechanism-Based Inactivation Study of Neutral Endopeptidase 24.11, *J. Med. Chem.* **1993**, *36*, 2408.
22. Imtiaz, U.; Manavathu, E. K.; Lerner, S. A.; Mobashery, S. A Critical Hydrogen Bond by Ser-235 for the Cephalosporinase Activity of the TEM-1  $\beta$ -Lactamase, *Antimicrob. Agents Chemother.* **1993**, *37*, 2438.
23. Siregar, J. J.; Lerner, S. A.; Mobashery, S. Purification and Characterization of Aminoglycoside 3'-Phosphotransferase Type II, and Kinetic Comparison with a New Mutant Enzyme, *Antimicrob. Agents Chemother.* **1994**, *38*, 641.
24. Grapsas, I.; Cho, Y. J.; Mobashery, S. N-(*t*-Butoxycarbonyloxy)-5-norbornene-*endo*-2,3-dicarboximide, A Reagent for the Regioselective Introduction of the *t*-Butoxycarbonyl (BOC) Protective Group at Unhindered Amines: Application to Aminoglycoside Chemistry, *J. Org. Chem.* **1994**, *59*, 1918.
25. Imtiaz, U.; Manavathu, E. K.; Mobashery, S.; Lerner, S. A. Reversal of Clavulanate Resistance Conferred by a Ser-244 Mutant of the TEM-1  $\beta$ -Lactamase as a Result of a Second Mutation (Arg to Ser at Position 164) That Enhances Activity Against Ceftazidime, *Antimicrob. Agents Chemother.* **1994**, *38*, 1134.
26. Imtiaz, U.; Billings, E. M.; Knox, J. R.; Mobashery, S. A Structure-Based Analysis of the Inhibition of Class A  $\beta$ -Lactamases by Sulbactam, *Biochemistry* **1994**, *33*, 5728.
27. Kocs, R.; Roestamadji, J.; Mobashery, S. A Convenient Triphosgene-Mediated Synthesis of Symmetric Carboxylic Acid Anhydrides, *J. Org. Chem.* **1994**, *59*, 2913.
28. Ghosh, S. S.; Said-Nejad, O.; Mobashery, S. A Rational Approach for the Design of Mechanism-Based Inactivators for Zinc Proteases, *Peptides: Chemistry, Structure and Biology*, Hodges, R. S. and Smith, J. A. (Eds.), **1994**, 607.
29. Tanaka, Y.; Grapsas, I.; Dakoji, S.; Cho, Y.J.; Mobashery, S. Conscripting the Active-Site Zinc Ion in Carboxypeptidase A in Inactivation Chemistry by a New Type of Irreversible Enzyme Inactivator, *J. Am. Chem. Soc.* **1994**, *116*, 7475.

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31. Grapsas, I.; Mobashery, S. Glyoxylyl Chloride *p*-Toluenesulfonyl Hydrazone, *Encyclopedia of Reagents for Organic Synthesis*, Paquette, L. A. (Editor-in-Chief), **1995**, 2624.
32. Taibi, P.; Mobashery, S. (Methylcarboxysulfamoyl)triethylammonium Hydroxide (Burgess Reagent) *Encyclopedia of Reagents for Organic Synthesis*, Paquette, L. A. (Editor-in-Chief), **1995**, 3345.
33. Grapsas, I.; Mobashery, S. *t*-Butoxycarbonylimidazole, *Encyclopedia of Reagents for Organic Synthesis*, Paquette, L. A. (Editor-in-Chief), **1995**, 835.
34. Grapsas, I.; Mobashery, S. 1-*t*-Butoxycarbonyl-1,2,4-triazole, *Encyclopedia of Reagents for Organic Synthesis*, Paquette, L. A. (Editor-in-Chief), **1995**, 843.
35. Grapsas, I.; Mobashery, S. 1-N-(*t*-Butoxycarbonyl)-1H-benzotriazole-3-N-oxide, *Encyclopedia of Reagents for Organic Synthesis*, Paquette, L. A. (Editor-in-Chief), **1995**, 833.
36. Siregar, J.J.; Mobashery, S. Methoxycarbonylsulfamoyl chloride, *Encyclopedia of Reagents for Organic Synthesis*, Paquette, L. A. (Editor-in-Chief), **1995**, 3344.
37. Roestamadji, J.; Grapsas, I.; Mobashery, S. Mechanism-Based Inactivation of Bacterial Aminoglycoside 3'-phosphotransferases, *J. Am. Chem. Soc.* **1995**, *117*, 80.
38. Bulychev, A.; Massova, I.; Lerner, S.A.; Mobashery, S. Penem BRL 42715: An Effective Inactivator for  $\beta$ -Lactamases, *J. Am. Chem. Soc.* **1995**, *117*, 4797.
39. Bulychev, A.; O'Brien, M.E.; Massova, I.; Teng, M.; Gibson, T.A.; Miller, M.J.; Mobashery, S. Potent Mechanism-Based Inhibition of the TEM-1  $\beta$ -Lactamase by Novel N-Sulfonyloxy  $\beta$ -Lactams, *J. Am. Chem. Soc.* **1995**, *117*, 5938.
40. Taibi, P.; Mobashery, S. Mechanism of Turnover of Imipenem by the TEM  $\beta$ -Lactamase Revisited, *J. Am. Chem. Soc.* **1995**, *117*, 7600.
41. Miyashita, K.; Mobashery, S. Mechanistic Support for the Stepwise Process for Inactivation of Class A  $\beta$ -Lactamases by Clavulanate, *Bioorg. Med. Chem. Lett.* **1995**, *5*, 1043.
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43. Vakulenko, S. B.; Taibi, P.; Toth, M.; Mobashery, S.; Lerner, S. A. Effect of Asp-179 Mutations in TEM<sub>p</sub>UC19  $\beta$ -Lactamase on Susceptibility to  $\beta$ -Lactamase, *Antimicrob. Agents Chemother.* **1995**, *39*, 1878.
44. Siregar, J.J.; Miroshnikov, K.; Mobashery, S. Purification, Characterization and Investigation of Mechanism of Aminoglycoside 3'-Phosphotransferase Type Ia, *Biochemistry* **1995**, *34*, 12681.

45. Roestamadji, J.; Grapsas, I.; Mobashery, S. Loss of Individual Electrostatic Interactions between Aminoglycoside Antibiotics and Resistance Enzymes as an Effective Means to Overcoming Bacterial Drug Resistance, *J. Am. Chem. Soc.* **1995**, *117*, 11060.
46. Miyashita, K.; Massova, I.; Taibi, P.; Mobashery, S. Design, Synthesis and Evaluation of a Potent Mechanism-Based Inhibitor for the TEM  $\beta$ -lactamase with Implications for the Enzyme Mechanism, *J. Am. Chem. Soc.* **1995**, *117*, 11055.
47. Miyashita, K.; Massova, I.; Mobashery, S. Quantification of the Extent of Attenuation of the Rate of Turnover Chemistry of the TEM-1  $\beta$ -Lactamase by the  $\alpha$ -1R-Hydroxyethyl Group in Substrates, *Bioorg. Med. Chem. Lett.*, **1996**, *6*, 319.
48. Ghosh, S.S.; Dakoiji, S.; Tanaka, Y.; Cho, Y.J.; Mobashery, S. Properties of Analogs of an Intermediate in the Process of Mechanism-Based Inactivation of Carboxypeptidase A, *Bioorganic Med. Chem.* **1996**, *4*, 1487.
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51. Taibi, P.; Massova, I.; Vakulenko, S.B.; Lerner, S.A.; Mobashery, S. Evidence for Structural Elasticity of  $\beta$ -Lactamases in the Course of Catalytic Turnover of the Novel Cephalosporin Cefepime, *J. Am. Chem. Soc.* **1996**, *118*, 7441.
52. Massova, I.; Martin, P.; de Mel, S.; Tanaka, Y.; Edwards, B.; Mobashery, S. Crystallographic and Computational Insight on the Mechanism of Zinc-Ion-Dependent Inactivation of Carboxypeptidase A by 2-Benzyl-3-Iodopropanoate, *J. Am. Chem. Soc.* **1996**, *118*, 12479.
53. Azucena, E.; Grapsas, I.; Mobashery, S. Properties of a Bifunctional Bacterial Antibiotic Resistance Enzyme That Catalyzes ATP-Dependent 2''-Phosphorylation and Acetyl-CoA-Dependent 6'-Acetylation of Aminoglycosides, *J. Am. Chem. Soc.* **1997**, *119*, 2317.
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55. Massova, I.; Mobashery, S. Molecular Bases for Interactions between  $\beta$ -Lactam Antibiotics and  $\beta$ -Lactamases, *Acct. Chem. Res.* **1997**, *30*, 162.
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60. Massova, I.; Kotra, L. P.; Mobashery, S. Structural Insight into the Binding Motifs for Calcium Ion and the Non-Catalytic Zinc in Matrix Metalloproteases, *Bioorganic Med. Chem. Lett.* **1998**, 8, 853.
61. Grapsas, I.; Mobashery, S. Synthetic Strategies for Regioselective Structural Modifications of Multifunctional Aminoglycoside Antibiotics, *Recent Res. Devel. in Organic Chem.* **1998**, 1, 469.
62. Grapsas, I.; Massova, I.; Mobashery, S. <sup>1</sup>H-NMR Analysis of Copper-Aminoglycoside Complexes in Solution and Its Implications for Regioselective Modification of Multifunctional Aminoglycoside Antibiotics, *Tetrahedron* **1998**, 54, 7705.
63. Vakulenko, S. B., Geryk, B.; Kotra, L. P.; Mobashery, S.; Lerner, S. A., Selection and Characterization of  $\beta$ -Lactam/ $\beta$ -Lactamase Inactivator-Resistant Mutants Following PCR Mutagenesis of the TEM-1  $\beta$ -Lactamase Gene, *Antimicrob. Agents Chemother.* **1998**, 43, 1542.
64. Massova, I.; Kotra, L. P.; Fridman, R.; Mobashery, S. Matrix Metalloproteases: Structures, Evolution and Diversification, *FASEB J.* **1998**, 12, 1075.
65. Kotra, L. P.; Mobashery, S.  $\beta$ -Lactam Antibiotics,  $\beta$ -Lactamases, and Bacterial Resistance, *Bull. Pasteur Institute* **1998**, 96, 139.
66. Mourey, L.; Miyashita, K.; Swarén, P.; Bulychev, A.; Samama, J. P.; Mobashery, S., Inhibition of the NMC-A  $\beta$ -lactamase by a Penicillanic Acid Derivative, and the Structural Bases for the Increase in Substrate Profile of This Antibiotic Resistance Enzyme, *J. Am. Chem. Soc.* **1998**, 120, 9383.
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75. Kotra, L.P.; Mobashery, S. Mechanistic and Clinical Aspects of  $\beta$ -Lactams and  $\beta$ -Lactamases. *Arch. Immunol. Ther. Ex.* **1999**, *47*, 211.
76. Swarén, P.; Golemi, D.; Cabantous, S.; Bulychev, A.; Maveyraud, L.; Mobashery, S.; Samama, J. P. X-Ray Structure of the Asn276Asp Variant of the *Escherichia coli* TEM-1  $\beta$ -Lactamase: Direct Observation of Electrostatic Modulation in Resistance to Inactivation by Clavulanic Acid, *Biochemistry*, **1999**, *38*, 9570.
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**Invited Lectures:**

1. Purdue University, Department of Chemistry, Identification of Active Site Amino Acid Residues in Catalytic Subunit of Bovine Cyclic AMP-Dependent Protein Kinase by Peptide-Based Affinity Inactivators, Nov., 1987.
2. Washington University, Department of Chemistry, Identification of Active Site Amino Acid Residues in Catalytic Subunit of Bovine Cyclic AMP-Dependent Protein Kinase by Peptide-Based Affinity Inactivators, Nov., 1987.
3. Brandeis University, Department of Biochemistry, Identification of Active Site Amino Acid Residues in Catalytic Subunit of Bovine Cyclic AMP-Dependent Protein Kinase by Peptide-Based Affinity Inactivators, Nov., 1987.
4. Wayne State University, Department of Chemistry, Identification of Active Site Amino Acid Residues in Catalytic Subunit of Bovine Cyclic AMP-Dependent Protein Kinase by Peptide-Based Affinity Inactivators, Dec., 1987.
5. Salk Institute Biotechnology/Industrial Associates, Active Site Structures of Protein Kinases, Jan., 1989
6. Wayne State University, Department of Biochemistry, Design of Mechanism-Based Inactivators for Zinc Proteases, Feb., 1989.
7. Schering-Plough Corporation, New Designs for Aminoglycoside Drugs, July, 1989.
8. Wayne State University, Department of Pharmaceutical Chemistry, Conscripting Active Site Metals in Metalloproteases in the Chemistry of Mechanism-Based Inactivation., Oct., 1990.
9. Schering-Plough Corporation, Mechanisms of Resistance to  $\beta$ -Lactam and Aminoglycoside Antibiotics, July, 1991.
10. Department of Medicinal Chemistry, University of Michigan, Mechanisms of Turnover of Substrates and Irreversible Inactivation by Mechanism-Based Inactivators of Class A  $\beta$ -Lactamases, Ann Arbor, Michigan, October 1991.
11. Department of Biochemistry, Wayne State University, Mechanisms of Turnover of Substrates and Irreversible Inactivation by Mechanism-Based Inactivators of Class A  $\beta$ -Lactamases, Detroit, Michigan, January 1992.
12. Regeneron Pharmaceuticals, Inc., Mechanistic Processes of Class A  $\beta$ -Lactamases, Tarrytown, New York, March 1992.
13. The Fifth  $\beta$ -Lactamase Workshop, A Structure-Based Insight into the Inactivation Chemistry of Class A  $\beta$ -Lactamases by Clavulanate, Holy Island, England, April 1992.
14. Department of Chemistry, University of Cincinnati, Biochemical Basis for Bacterial Resistance to  $\beta$ -lactam Antibiotics, November 1992.

15. Department of Nutrition and Food Sciences, Wayne State University, A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, November 1992.
16. Department of Chemistry, Wayne State University, A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, November 1992.
17. The Upjohn Co., A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, February 1993.
18. Ajinomoto Co.,  $\beta$ -Lactam Drug Resistance in Bacteria: Mechanistic Insight into the Processes of Class A  $\beta$ -Lactamases, Kawasaki, Japan, June 1993.
19. Ono Pharmaceutical Co., Conscripting the Catalytic Machinery of Enzymes in Development of Pharmaceuticals: Rational Design of the First Generation of Mechanism-Based Inactivators for Zinc Proteases, Osaka, Japan, June 1993.
20. Protein Engineering Research Institute,  $\beta$ -Lactam Drug Resistance in Bacteria: Mechanistic Insight into the Processes of Class A  $\beta$ -Lactamases, Osaka, Japan, June 1993.
21. Suntory Biomedical Institute, A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, Osaka, Japan, June 1993.
22. Second International Symposium on Bioorganic Chemistry, Mechanistic Insight from Modeling on the Inactivation Chemistry of  $\beta$ -Lactamases by Clavulanate, Fukuoka, Japan, June 1993.
23. Department of Chemistry, Scripps Institute, Overcoming Resistance to  $\beta$ -Lactam Drugs, La Jolla, California, November 1993.
24. University of Detroit, Department of Chemistry, A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, January 1994.
25. Wayne State University, Department of Pharmacology, A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, January 1994.
26. Schering-Plough Corporation, Mechanisms of Resistance to  $\beta$ -Lactam and Aminoglycoside Antibiotics, January 1994.
27. Department of Biological Chemistry, University of Michigan, A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, The Enzyme Discussion Group, February 1994.
28. University of California at Santa Cruz, A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, Department of Chemistry, February 1994.
29. Department of Chemistry, University of Minnesota, A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, March 1994.
30. The joint 26th Central Regional/27th Great Lakes Regional ACS meeting, Mechanism-Based Inactivation of Zinc Proteases, Ann Arbor, Michigan, June 1994.

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31. Gordon Conference on Enzymes, Cofactors, and Metabolic Pathways, Overcoming Resistance to  $\beta$ -Lactam Drugs: Novel Strategies for Inhibition of  $\beta$ -Lactamases, New Hampshire, July 1994.
32. Department of Chemistry, State University of New York at Buffalo, A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, September 1994.
33. Department of Chemistry, Michigan Technological University, A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, September 1994.
34. American Society for Microbiology National Meeting, Prospect for the Use of  $\beta$ -Lactamase Inhibitors in Clinic for the Next 15 Years; Orlando, Florida, October 1994.
35. Department of Chemistry, Indiana University (Bloomington), A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, November 1994.
36. SmithKline-Beecham Pharmaceutical Co., A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, Brockham Park, UK, November 1994.
37. Department of Chemistry, University of Exeter, A Structure-Based Analysis of the Processes of the Class A  $\beta$ -Lactamases, Exeter, UK, November 1994.
38. Department of Biochemistry, University of Liège, Mecanismes de Resistance des  $\beta$ -Lactam Antibiotiques Causés par le TEM  $\beta$ -Lactamase, Liège, Belgium, November 1994.
39. Department of Chemistry, Ecole Supérieure de Chimie Industrielle de Lyon, Mecanismes de Resistance des  $\beta$ -Lactam Antibiotiques Causés par le TEM  $\beta$ -Lactamase, Lyon, France, November 1994.
40. Laboratoire de Pharmacologie et de Toxicologie Fondamentales, Centre National de la Recherche Scientifique, S., Mecanismes de Resistance des  $\beta$ -Lactam Antibiotiques Causés par le TEM  $\beta$  Lactamase, Toulouse, France, November 1994.
41. Cornell University School of Medicine, Molecular Basis for Bacterial Resistance to  $\beta$ -Lactam Antibiotics, New York, December 1994.
42. Department of Chemistry, Oakland University, Resistance to  $\beta$ -Lactam Antibiotics, January 1994.
43. The First International Workshop on Enzyme Inhibitor Design, Design of Mechanism-Based Enzyme Inactivators as Potential Pharmaceuticals, Pohang, Korea, February 1995.
44. Dong-A Pharmaceutical Co., Design of Mechanism-Based Enzyme Inactivators as Potential Pharmaceuticals, Seoul, Korea, February 1995.
45. The Sixth  $\beta$ -Lactamase Workshop, Holy Island, Novel Mechanism-Based Inhibitors for  $\beta$ -Lactamases, UK, April 1995.
46. Plenary Lecture, 13th Summer Symposium on Organic Synthesis, Mobashery, S., Design and Synthesis of Biologically Active Compounds, Fukuoka city, Japan, July 1995.
47. Kyoto Pharmaceutical University, Department of Medicinal Chemistry, Overcoming Resistance to Antibiotic, Kyoto, Japan, August 1995.

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48. Osaka University, Faculty of Pharmaceutical Sciences, Overcoming Resistance to Antibiotic, Osaka, Japan, August 1995.
49. Suntory Institute for Bioorganic Research, Overcoming Resistance to Antibiotic, Osaka, Japan, August 1995.
50. Affymax Corp., Overcoming Resistance to Antibiotic, Santa Clara, California, September 1995.
51. 35th Interscience Conference on Antimicrobial Agents and Chemotherapy, Turnover of the Fourth-Generation Cephalosporin Cefepime by the TEM-1  $\beta$ -Lactamase: Evidence for Conformational Flexibility of Enzyme, San Francisco, September 1995.
52. Department of Chemistry, Case Western Reserve University, Cleveland, Chemical Strategies for Overcoming Resistance to Antibiotics, Ohio, September 1995.
53. Pharmacia-Upjohn Co., Overcoming Resistance to Antibiotic, Kalamazoo, MI, November 1995.
54. International Chemical Congress of Pacific Basin Societies, Overcoming Resistance to Antibiotic, Honolulu, December 1995.
55. Wyeth-Ayerst Research/Lederle laboratories, Mechanisms of  $\beta$ -Lactamases and the Challenge of Inhibition, Pearl River, New York, March 1996.
56. School of Pharmaceutical Sciences, Beijing Medical University, The People's Republic of China, Mechanisms of  $\beta$ -Lactamases and the Challenge of Inhibition, May 1996.
57. National Laboratory of Natural and Biomimetic Drugs, Beijing Medical University, The People's Republic of China, Beta-lactamases: Evolution of a Versatile Bacterial Catalyst, May 1996.
58. Interscience Conference on Antimicrobial Agents and Chemotherapy, Mechanism of Deacylation for Class A  $\beta$ -Lactamases, New Orleans, Louisiana, September 1996.
59. Schering-Plough Corp., Overcoming Resistance to Antibiotic, Kenilworth, NJ, October 1996.
60. Sixteenth Midwest Enzyme Chemistry Conference, Chicago, Illinois, Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: From Biosynthetic enzymes to Drug Resistance Factors, October 1996.
61. Case Western Reserve University, Department of Pharmacology, Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: From Biosynthetic enzymes to Drug Resistance Factors, October 1996.
62. Stanford University, Department of Chemistry, Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: From Biosynthetic enzymes to Drug Resistance Factors, November 1996.
63. University of Michigan at Dearborn, Overcoming Resistance to Antibiotic, November 1996.

64. Wayne State University, Department of Chemistry, Frontiers of Science Lecture Series, Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: From Biosynthetic Enzymes to Drug Resistance Factors, December 1996.
65. Affymax Corp., Santa Clara, California, Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: From Biosynthetic Enzymes to Drug Resistance Factors, December 1996.
66. McMaster University, Department of Biochemistry, Hamilton, Ontario, Canada, Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: From Biosynthetic Enzymes to Drug Resistance Factors, December 1996.
67. University of Waterloo, Department of Chemistry, Waterloo, Ontario, Canada, Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: From Biosynthetic Enzymes to Drug Resistance Factors, December 1996.
68. Schering-Plough Corp., Kenilworth, New Jersey, Cephalosporin-Aminoglycoside Conjoint Antibacterials, December 1996.
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70. University of Texas, Department of Chemistry, Arlington, Texas, Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: From Biosynthetic Enzymes to Drug Resistance Factors, January 1997.
71. Duke University, Department of Chemistry, Durham, North Carolina, Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: From Biosynthetic Enzymes to Drug Resistance Factors, January 1997.
72. Bristol-Myers Squibb, Wallingford, Connecticut, Bacterial  $\beta$ -lactamases: Nuances of Mechanisms and Challenge of Inhibition, March 1997.
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74. University of Bern, Department of Chemistry, Evolution of Versatile Bacterial Catalysts: From Biosynthetic enzymes to Drug Resistance Factors, Bern, Switzerland, April 1997.
75. Hoffmann-La Roche Pharmaceutical Co., Evolution of Versatile Bacterial Catalysts: From Biosynthetic enzymes to Drug Resistance Factors, Basel, Switzerland, April 1997.
76. Centre National de la Recherche Scientifique, Toulouse, France, Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: From Biosynthetic Enzymes to Drug Resistance Factors, April 1997.
77. University of Toledo, Department of Medicinal Chemistry, Bacterial  $\beta$ -lactamases: Nuances of Mechanisms and Challenge of Inhibition, April 1997.
78. Symposium on Antibacterial Drug Resistance and New Developments in Antibiotics, Wayne State University, "Enzymes of Drug Resistance", May 1997.

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79. Gordon Conference on Bioorganic Chemistry, "Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: from Biosynthetic enzymes to Drug Resistance Factors ", Andover, New Hampshire, June 1997.
80. Abbott Pharmaceutical Co., "Bacterial  $\beta$ -lactamases: Nuances of Mechanisms and Challenge of Inhibition, July 1997.
81. Procter & Gamble Pharmaceuticals, "Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: from Biosynthetic enzymes to Drug Resistance Factors ", Cincinnati, Ohio, August 1997.
82. Notre Dame University, "Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: From Biosynthetic enzymes to Drug Resistance Factors", Notre Dame, Indiana, September, 1997.
83. Department of Biochemistry, WSU, "Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: from Biosynthetic enzymes to Drug Resistance Factors", Detroit, MI, October 1997.
84. The Fifth International Symposium on Protease Inhibitors and Biological Control, "Computational Insight into Structures, Substrate Preference and Inhibition by Protein Inhibitors of Human Gelatinases", Brdo, Slovenija, October, 1997.
85. Department of Biochemistry, Albert Einstein College of Medicine, "Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: from Biosynthetic enzymes to Drug Resistance Factors", October 1997.
86. Consiglio Nazionale delle Ricerche, "Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: from Biosynthetic enzymes to Drug Resistance Factors", Bologna, Italy, October 1997
87. Kresge Eye Institute, "Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: from Biosynthetic enzymes to Drug Resistance Factors", Detroit, MI, November 1997.
88. Wyeth-Ayerst Research/Lederle laboratories "Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: from Biosynthetic enzymes to Drug Resistance Factors", Pearl River, New York, January 1998.
89. Aurora Biosciences Corporation, "Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: from Biosynthetic enzymes to Drug Resistance Factors", San Diego, CA, March 1998.
90. Hoechst-Marion-Roussel Pharmaceutical Co, "Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: from Biosynthetic enzymes to Drug Resistance Factors", Paris, France, March 1998.
91. Institut de Pharmacologie et de Biologie Structurale, "Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: from Biosynthetic enzymes to Drug Resistance Factors", Toulouse, France, March 1998.
92. Oxford University, The Centre for Molecular Sciences, "Bacterial  $\beta$ -lactamases: Nuances of Mechanisms and Challenge of Inhibition", Oxford, U.K., April 1998.

93. The Seventh  $\beta$ -Lactamase Workshop, "Structural and Mechanistic Implications for Evolution of  $\beta$ -Lactamases from Penicillin-Binding Proteins", Holy Island, UK, April 1998.
94. Department of Pharmacology, Wayne State University, "Structural and Mechanistic Implications for Evolution of  $\beta$ -Lactamases from Penicillin-Binding Proteins", April 1998.
95. Bristol-Myers Squibb, Wallingford, Connecticut, "Selection of Novel Resistance to Expanded-Spectrum  $\beta$ -Lactam Antibiotics", August 1998.
96. Symposium on *Unravelling the Biological and Pathological Functions of Proteolytic Enzymes*, Wayne State University School of Medicine, "Strategies for Inhibition of Proteases", October, 1998.
97. Schering Plough Corp., "Antibiotics: The Twentieth-Century "Silver Bullets" and How They Are Being Tarnished", November 1998.
98. Southern Illinois University, Department of Chemistry, "Evolution of the Versatile  $\beta$ -lactam Hydrolase Activity: from Biosynthetic enzymes to Drug Resistance Factors", January 1999.
99. Washington University, Department of Chemistry, "Antibiotics: The Twentieth-Century Miracle Drugs and How They Are Being Tarnished", January 1999.
100. Ohio State University of "Structural and Mechanistic Implications for Evolution of  $\beta$ -Lactamases from Penicillin-Binding Proteins", April, 1999.
101. Georgia Institute of Technology, "Antibiotics: The Twentieth-Century "Silver Bullets" and How They Are Being Tarnished", April, 1999.
102. International Meeting on  $\beta$ -Lactamase-Mediated Resistance: Molecular Aspects and Clinical Implications, L'Aquila, "Structural and Mechanistic Bases for Evolution of  $\beta$ -Lactamases", Italy, June 1999.
103. Department of Chemistry, Universidad Islas Baleares, "Modelización de Interacciones Enzima-Sustrato", Palma Mallorca, Spain, June 1999.
104. University of Grenoble, Grenoble, France, "Antibiotics: The Twentieth-Century "Silver Bullets" and How They Are Being Tarnished", June 1999.
105. Consiglio Nazionale delle Ricerche, "Chemical Strategies in Design of Inhibitors for Proteases", Bologna, Italy, June 1999.
106. Interscience Conference on Antimicrobial Agents and Chemotherapy, "High-Resolution Imaging of the Assembly of the Bacterial Outer-membrane", San Francisco, California, September 1999.
107. University of Iowa, "Antibiotics: The Twentieth-Century "Silver Bullets" and How They Are Being Tarnished", September, 1998.
108. International Proteolysis Society: Protease Consortium, Mackinac, Michigan, "Strategies for Protease Inhibition", October 1999.

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109. Loyola University of Chicago, "Antibiotics: Twentieth Century "Magic Bullets" and How They are being tarnished", Chicago, November 1999.
110. The Second International Conference on Protease Inhibitors, Gainesville, "New Methodology for Inhibition of Proteases", December 1999.
111. University of Alberta, "Structural and Mechanistic Implications for Evolution of  $\beta$ -Lactamases from Penicillin-Binding Proteins", Edmonton, Canada, December 1999.
112. Michigan State University, Department of Biochemistry, "Structural and Mechanistic Implications for Evolution of  $\beta$ -Lactamases from Penicillin-Binding Proteins", February 2000.
113. Purdue University, Department of Medicinal Chemistry, "Structural and Mechanistic Implications for Evolution of  $\beta$ -Lactamases from Penicillin-Binding Proteins", March 2000.
114. Launching Ceremony for the Institute for Scientific Computing, Wayne State University, "Drug Discovery and Computational Chemistry", April 2000.
115. Cerus Science Retreat: New Opportunities & Competing Technologies, "Overcoming Resistance to Antibiotics", Santa Cruz, California, May 2000.
116. Guilford Pharmaceutical Company, "Methodology for Mechanism-based Inhibition of Zinc-Dependent Proteases", Baltimore, June 2000.
117. Gordon Research Conference on Enzymes, Coenzyme, and Metabolic Pathways, "Cross linking of the bacterial cell wall by penicillin-binding proteins, and how this activity has given rise to antibiotic resistant determinants", July 2000.
118. University of Michigan, "Cross linking of the bacterial cell wall by penicillin-binding proteins, and how this activity has given rise to antibiotic resistant determinants", September 2000.
119. Wayne State University, Department of Pharmacology, "Cross linking of the bacterial cell wall by penicillin-binding proteins, and how this activity has given rise to antibiotic resistant determinants", October 2000.
120. Vanderbilt University, " $\beta$ -Lactam Antibiotics: The Twentieth-Century "Silver Bullets" and How They Are Being Tarnished", October 2000.
121. The Developmental Therapeutics Program, WSU, " $\beta$ -Lactam Antibiotics: The Twentieth-Century "Silver Bullets" and How They Are Being Tarnished", November 2000.
122. Michigan State University, "Cross linking of the bacterial cell wall by penicillin-binding proteins, and how this activity has given rise to antibiotic resistant determinants", December 2000.

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123. International Chemical Congress of Pacific Basin Societies ("Pacifichem 2000"), "Antibiotics: Twentieth Century "How Bacteria Cross-Link Their Cell Walls: Target for Antibiotics", Honolulu, December 2000.
124. DARPA, "Bacterial Envelope", San Francisco, January 2001.
125. Karmanos Cancer Institute, "Gelatinases and Cancer Metastasis: Insights into the Complex Processes of Enzyme Inhibition and Zymogen Activation", February 2001.
126. University of Western Ontario, " $\beta$ -Lactam Antibiotics: The Twentieth-Century "Silver Bullets" and How They Are Being Tarnished", February 2001.
127. Florida State University, "Gelatinases and Cancer Metastasis: Insights into the Complex Processes of Enzyme Inhibition and Zymogen Activation", March 2001
128. Keynote Lecture, Bioferma Chair Lectureship, University of Murcia, Spain, Antibioticos: El Milagro Medico del Siglo Veinte y Como Estan Perdiendo Efectividad Terapeutica", March 2001.
129. University of Murcia, Spain, "Cross linking of the bacterial cell wall by penicillin-binding proteins, and how this activity has given rise to antibiotic resistant determinants", March 2001.
130. University of the Balears Islands, Spain, "Cross linking of the bacterial cell wall by penicillin-binding proteins, and how this activity has given rise to antibiotic resistant determinants", March 2001.
131. Indiana University, "Cross linking of the bacterial cell wall by penicillin-binding proteins, and how this activity has given rise to antibiotic resistant determinants", March 2001.
132. Plenary Lecture, National Meeting of the Korea Chemical Society, Seoul, Korea, "Matrix Metalloproteinases: Structures, Function, and Inhibition", April 2001.
133. Symposium on Chemical Genomics, Pohang University of Science and Technology, Pohang, Korea, "Cross linking of the bacterial cell wall by penicillin-binding proteins, and how this activity has given rise to antibiotic resistant determinants", April 2001.
134. DuPont Pharmaceuticals Co., "Cross linking of the bacterial cell wall by penicillin-binding proteins, and how this activity has given rise to antibiotic resistant determinants", Wilmington, April 2001.
135. NewBiotics Pharmaceuticals Co., "Cross linking of the bacterial cell wall by penicillin-binding proteins, and how this activity has given rise to antibiotic resistant determinants", San Diego, April 2001.
136. Trends in Drug Research, 13<sup>th</sup> Noordwijkerhout-Camerino Symposium, "Antibiotic Design for Validated Targets", Noordwijkerhout, Netherlands, May 2001.
137. The 101th General Meeting of the American Society for Microbiology, "Biochemical and Structural Insights into Class D  $\beta$ -lactamases", Orlando, May 2001.
138. Plenary Lecture, in *Trends in Organic Chemistry* of the Swedish Royal Academy of Sciences, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", Stockholm, Sweden, May 2001.

139. American Chemical Society, Great Lakes Regional Meeting, "Novel Aminoglycosides by Design", Grand Rapids, June 2001.
140. The 222nd National Meeting of the American Chemical Society, Symposium on "Inhibition of Enzymes Important in Medicine", "Matrix metalloproteinases: structures, function, and inhibition", Chicago, Illinois, August 2001.
141. Bioinformatics and Structural Modeling Workshop, Istanbul, Turkey, "Applications of Molecular Modeling to Systems of Importance to Biological Sciences", September 2001.
142. Institute of Molecular Chemistry, University of Amsterdam, The Netherlands "Cancer Metastasis and Matrix metalloproteinases: structures, function, and inhibition", September 2001.
143. Department of Chemistry, University of Montreal, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", Montreal, Canada, December 2001.
144. Frontiers of Science Lecture, Department of Chemistry, Wayne State University, "Matrix metalloproteinases: structures, function, and inhibition", January 2002.
145. National Institute of Child Health, Perinatology Research Branch, "Matrix metalloproteinases: structures, function, and inhibition", January 2002.
146. National Academy of Sciences, Institute of Medicine, Forum on Emerging Infections, Washington, D.C., Emergence of Multiple Mechanisms of Resistance to Antibacterials, February 2002.
147. Ohio State University, Department of Biochemistry, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", March 2002.
148. The Eight  $\beta$ -Lactamase Workshop, "Inhibitor-Resistant  $\beta$ -Lactamases", Holy Island, UK, March, 2002.
149. Case-Western Reserve University, Department of Pharmacology, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", April 2002.
150. Frontiers in Medicinal Chemistry Lecture, University of Utah, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", April 2002.
151. The 223<sup>rd</sup> National Meeting of the American Chemical Society, Symposium on "Carbohydrate Chemistry", "Retailoring Aminoglycoside Antibiotics Based on Ribosomal Target Structure and Mechanistic Considerations", Orlando, April 2002.
152. Antimicrobial Research Centre, McMaster University, Canada, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", May 2002.
153. University of Toronto, Canada, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", May 2002.
154. International Conference on Genomics, Proteomics and Bioinformatics, "Design of Novel Antibiotics that Bind to the Bacterial Ribosomal Acyltransfer Site", St Petersburg, Russia, June 2002.

155. ImClone Corp., "Matrix Metalloproteinases and Their Involvement in Cancer Metastasis", New York, August 2002.
156. The 224<sup>th</sup> National Meeting of the American Chemical Society, Symposium on "metalloproteases", "Matrix Metalloproteinases and Their Involvement in Cancer Metastasis", Boston, August 2002.
157. Washington State University, Department of Chemistry, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", September 2002.
158. University of Connecticut, "Protein and Polymer Science in the 21st Century" Symposium in the Honor of Professor James Knox, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", September 2002.
159. University of Washington, Department of Chemistry, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", October 2002.
160. University of Notre Dame, Department of Chemistry and biochemistry, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", October 2002.
161. Pharmacia Symposium on Molecular Target-Based Cellular and Animal Models, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", October 2002.
162. Tufts University, Department of Chemistry, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", October 2002.
163. Ohio Wesleyan University, Department of Chemistry, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", November 2002.
164. Purdue University, Department of Chemistry, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", November 2002.
165. Baylor College of Medicine, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", January 2003.
166. Center for Biological Modeling, Michigan State University, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", January 2003.
167. University of Washington, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", February 2003.
168. Chemistry Colloquia, University of Nebraska, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", April 2003.
169. Fargo Conference on Metalloproteinases, "Inhibition and Activation of Gelatinases", Fargo, North Dakota, May 2003.
170. IUPAC Symposium on New Targets for Antibacterials, "New Designer Antibiotics; Old and New Targets", Amsterdam, Netherlands, June 2003.
171. Rigel Inc., "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", South San Francisco, July 2003.

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172. Symposium on "Biomolecular Structure, Cellular Structure and Drug Discovery", International Union of Biochemistry and Molecular Biology Congress, Toronto, Canada, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", July 2003.
173. Gordon Research Conference on Matrix Metalloproteinases, "Contributions of Molecular Dynamics to Biochemistry of MMPs", Big Sky, Montana, August 2003.
174. Science Advisory Council, University of Notre Dame, "Science at the Interface of Chemistry and Biology", September 2003.
175. Plenary Lecture, The XIV National Symposium in Organic Chemistry of the Argentinian Society of Organic Chemistry, "Antibioticos: El Milagro Medico del Siglo Veinte y Como Estan Perdiendo Efectividad Terapeutica", Rosario, Argentina, November 2003.
176. Instituto de Biologia de Rosario, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", Rosario, Argentina, November 2003.
177. Chemistry Colloquium Speaker, Wichita State University, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", December 2003.
178. Andrews University, "Bacterial Cell Wall, the Ribosome, and Antibiotics", March 2004.
179. Chemical Biology Lecture Series, University of Illinois at Urbana-Champaign, "Antibacterials as Wonder Drugs and How Their Effectiveness Is Being Compromised", April 2004.
180. The 14<sup>th</sup> European Congress of Clinical Microbiology and Infectious Diseases (ECCMID), "Resistance to  $\beta$ -Lactam Antibiotics in *Staphylococcus aureus*", Prague, Czech Republic, May 2004.
181. University of Parma, "Bacterial Cell Wall, the Ribosome, and Antibiotics", May 2004.
182. National Meeting of the American Society for Microbiology, "BlaR of *Staphylococcus aureus* and Its Involvement in Signal Transduction of Antibiotic Resistance", New Orleans, May 2004.
183. Second Chianti Meeting on Proteases, "Design and Synthesis of a Selective Mechanism-Based Inhibitor for Gelatinases, Which Inhibit Metastasis in a Mouse Model of T-Cell Lymphoma", Siena, May 2004.
184. Symposium on "Biomolecular Structure, Cellular Structure and Drug Discovery", International Union of Biochemistry and Molecular Biology Congress, Toronto, Canada, "Drug Design at the Interface of Chemistry and Biology", July 2004.
185. Plenary Lecture, International Symposium on the Frontiers of Chemistry in Honor of Professor Dong Kim, Pohang University of Science and Technology, "Bacterial Cell Wall, the Ribosome, and Antibiotics", Pohang, Republic of Korea, August 2004.
186. Walther Cancer Institute Retreat, "Design and Synthesis of a Selective Mechanism-Based Inhibitor for Gelatinases, Which Inhibit Metastasis and Proliferation in Animal Models for Lymphoma and Prostate Cancer", Notre Dame, August 2004.

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187. International Meeting on Inhibition of Matrix Metalloproteinases: Expanding the Horizons, "Design and Synthesis of a Selective Mechanism-Based Inhibitor for Gelatinases", New York City, October 2004.
188. Northwestern University, "Bacterial Cell Wall, the Ribosome, and Antibiotics", November 2004.
189. University of Kentucky, "Bacterial Cell Wall, the Ribosome, and Antibiotics", March 2005.
190. The 9<sup>th</sup>  $\beta$ -Lactamase Meeting, "Bacterial Cell Wall", Leonessa, Italy, June 2005.
191. The 9<sup>th</sup>  $\beta$ -Lactamase Meeting, "Crystal Structure of the Acylated  $\beta$ -Lactam Sensor Domain of BlaR1 from *Staphylococcus aureus*", Leonessa, Italy, June 2005.
192. The Burnham Institute, "Mechanism-Based Approaches for Biological Intervention of Disease", San Diego, July 2005.
193. Schering-Plough Corp, "Design, Synthesis and Evaluation of a Selective Mechanism-Based Inhibitor for Gelatinases as a Strategy in Intervention of Cancer Metastasis", Cambridge, MA, August 2005.
194. National Meeting of the American Chemical Society, "Circumventing Antibiotic Resistance", Washington DC, September 2005.
195. New Developments in Synthetic Organic Chemistry of Natural Product and Medicine, "Bacterial Cell Wall, the Ribosome, and Antibiotics", Kyoto, Japan, September 2005.
196. University of Osaka, School of Pharmacy, "Bacterial Cell Wall, the Ribosome, and Antibiotics", Osaka, Japan, September 2005.
197. University of Osaka, Graduate School of Medicine, "Evaluation of a de Novo Designed Selective Mechanism-Based Inhibitor for Gelatinases as a Strategy in Intervention of Cancer Metastasis and Alleviation of the Consequences of Stroke", Osaka, Japan, September 2005.
198. Osaka Prefecture University, "Bacterial Cell Wall, the Ribosome, and Antibiotics", Osaka, Japan, September 2005.
199. World High Technology Society 3rd Annual Congress, Shanghai, China, October, 2005
200. University of California at San Diego, "Bacterial Cell Wall, the Ribosome, and Antibiotics", January 2006.
201. Frontier of Science Lecture, Case-Western University, "Bacterial Cell Wall, the Ribosome, and Antibiotics", January 2006.
202. University of Minnesota, Department of Medicinal Chemistry, "Bacterial Cell Wall, the Ribosome, and Antibiotics", February 2006.
203. University of Hong Kong, Department of Chemistry, "Bacterial Cell Wall, the Ribosome, and Antibiotics", April 2006.

204. Hong Kong University of Science and Technology, "Bacterial Cell Wall, the Ribosome, and Antibiotics", May 2006.
205. University of Hong Kong, Department of Microbiology, "Emergence of *Staphylococcus aureus* as a Clinical Scourge", May 2006.
206. University of Minnesota, Center for Drug Design, "Emergence of *Staphylococcus aureus* as a Clinical Scourge", June 2006.
207. Merck & Co., "Emergence of *Staphylococcus aureus* as a Clinical Scourge", Rhaway, NJ, August 2006.
208. American Chemical Society National Meeting, "Synthesis and Three-Dimensional Structure of a Fragment of the Bacterial Cell Wall Peptidoglycan", San Francisco, September 2006.
209. North Eastern Structure Symposium: Structural Insights into Macromolecular Assemblies, "Three-Dimensional Structure of the Bacterial Cell Wall Peptidoglycan", University of Connecticut, September 2006.
210. Northern Illinois University, "Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", January 2007.
211. Delhi University, Department of Chemistry, "Chemistry of Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", New Delhi, India, March 2007.
212. Third International Symposium on Current Trends in Drug Discovery Research, "Control of Extra-cellular Matrix Degradation by Small Molecules in Prevention of Disease", Lucknow, India, February 2007.
213. Second International Conference on Pharmaceutical Sciences & Practice, "Control of Extra-cellular Matrix Degradation by Small Molecules in Prevention of Disease", Ooty, India, February 2007.
214. University of Montreal, Department of Chemistry, "Chemistry of Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", Montreal, Canada, March 2007.
215. The Merck Frosst Lecture, Simon Fraser University, "Bacterial Cell Wall, the Ribosome, and Antibiotics", Vancouver, Canada, March 2007.
216. The Rising Lecture, Oregon State University, "Chemistry of Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", April 2007.
217. IUPAC Symposium on New Targets for Antibacterials, "The *Mec* and *Bla* Operons and Resistance to Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", April 2007.
218. The Ohio State University, Department of Chemistry Colloquium, "Chemistry of Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", April 2007.

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219. The 107<sup>th</sup> General Meeting of the American Society for Microbiology, "Regulation of  $\beta$ -Lactam Antibiotic Resistance in Methicillin-Resistant *Staphylococcus aureus* and Its Origins", Toronto, Canada, May 2007.
220. International Conference on the Chemistry of Antibiotics and other Bioactive Compounds (ICCA-10), "Bacterial Cell Wall", Vanderbilt University, August 2007.
221. Albany Molecular, "Bacterial Cell Wall and Antibiotics", September 2007.
222. University of Pennsylvania, "Bacterial Cell Wall", October 2007.
223. Pasteur Institute, French Society of Microbiology, "Antibiotic Resistance Mechanisms in Methicillin-Resistant *Staphylococcus Aureus*", Paris, France, December 2007.
224. The Peptidoglycan Symposium at the University of Wisconsin, "Structure of the Bacterial Peptidoglycan", December 2007.
225. University of California, Davis, "Bacterial Cell Wall and Antibiotics", Jan 2008.
226. University of New Orleans, "Bacterial Cell Wall and Antibiotics", Jan 2008.
227. Grand Valley State University, "Bacterial Cell Wall", Feb. 2008.
228. Vanderbilt University Institute for Chemical Biology, "Chemistry of Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", Jan 2008.
229. Keynote Speaker, The 28th Annual Symposium in the Pharmacological Sciences and Biorelated Chemistry, University of Michigan, "Chemistry of Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", March 2008.
230. American Chemical Society National Meeting, "Role of the Active Site Zinc Ion of Matrix Metalloproteinases in Enzyme Activation and Its Subversion in the Process of Selective Inhibition", New Orleans, April 2008.
231. Merck & Co., "Bacterial Cell Wall", Rhaway, NJ, April 2008.
232. University of New Orleans, "Bacterial Cell Wall", New Orleans, April 2008.
233. The 10<sup>th</sup>  $\beta$ -Lactamase Meeting, "Penicillin-Binding Protein 5 of *Escherichia coli* and Its Implications for  $\beta$ -Lactamases, Eretria, Greece, June 2008.
234. Universitat Autònoma de Barcelona, "Mechanism of Matrix Metalloproteinase Activation and the Process of Selective Inhibition", Barcelona, Spain, June 2008.
235. Molecular Biology Institute of Barcelona (CSIC), "Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", Barcelona, Spain, June 2008.
236. Instituto de Química-Física Rocasolano, Spanish National Research Council, "Bacterial Cell Wall", Madrid, Spain, June 2008.
237. NovaBay Pharmaceuticals, Inc., "Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", Emeryville, CA, July 2008.
238. Theravance Pharmaceutical Co., "Bacterial Cell Wall", San Francisco, CA, Aug. 2008.

239. The Astellas Award Lecture, American Chemical Society National Meeting, "Bacterial Cell Wall", Philadelphia, August 2008.
240. Plenary Lecture, The XII International Congress of Bacteriology and Applied Microbiology of the International Union of Microbiology Societies (IUMS), "Bacterial Cell Wall, Its Regulation and Involvement in Antibiotic Resistance", Istanbul, Turkey, August, 2008.
241. Université Catholique de Louvain, "Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", Brussels, Belgium, September 2008.
242. Harvard University, "Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", Boston, September 2008.
243. University of Rosario, "Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", Rosario, Argentina, November, 2008.
244. University of Missouri-Columbia School of Medicine, "Role of the Active Site Zinc Ion of Matrix Metalloproteinases in Enzyme Activation and Its Subversion in the Process of Selective Inhibition", Columbia, December 2008.
245. Indiana University School of Medicine—Northwest, "Bacterial Cell Wall", December 2008.
246. Plenary Lecture, The Ninth Winter Conference on Bioorganic & Medicinal Chemistry "Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", Steamboat, Colorado, January 2009.
247. University of Georgia, "Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", Athens, March 2009.
248. Workshop on Biomedical Research, "Bacterial Cell Wall", University of Notre Dame, March 2009.
249. New York University, "Bacterial Cell Wall", April 2009
250. The National Meeting of the American Society for Microbiology, "Bacterial Cell Wall", Philadelphia, May 2009.
251. Gordon Conferences on Matrix Metalloproteinases, "Progression of Studies on Mechanism-based Inhibitors for Gelatinases", Diablerets, Switzerland, August 2009.
252. Academia Sinica, "Bacterial Cell Wall", Taipei, Taiwan, September 2009.
253. Academia Sinica, "Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)", Taipei, Taiwan, September 2009.
254. AstraZeneca, "Bacterial Cell Wall", Waltham, MA, September 2009.
255. University of Oklahoma, "Bacterial Cell Wall", Norman, OK, October 2009.
256. The Meeting of the UK-Canada Bacterial Cell Wall Biosynthesis Network, "Turnover of the Bacterial Cell Wall", Warwick, The United Kingdom, November 2009.

257. Gordon Research Conference on New Antibacterial Drug Discovery and Development, “\*\*\*”, Galveston, TX, March 2010.
258. The National Meeting of the American Society for Biochemistry and Molecular Biology, “Resistance to  $\beta$ -Lactam Antibiotics in Methicillin-Resistant *Staphylococcus aureus* (MRSA)”, Anaheim, April 2010.
259. Gordon Research Conference on Bioorganic Chemistry, “\*\*\*”, Andover, New Hampshire, June 2010.
260. World Congress of Pharmacy & Pharmaceutical Sciences 2010, 70<sup>th</sup> International Congress of Pharmaceutical Federation, “\*\*\*”, Lisbon, Portugal, August 2010.

**Lectures to General Audience:**

1. Devine-Child High School, "Antibiotics: The Twentieth-Century "Silver Bullets" and How They Are Being Tarnished", January 1998.
2. Universidad de Murcia, Murcia, Spain, “Antibioticos: Pasado, Presente, y Futuro”, April 2001.
3. University of Hong Kong, Hong Kong, China, "Antibiotics: The Twentieth-Century "Silver Bullets" and How They Are Being Tarnished", May 2006.
4. The Merck Frosst Lecture, Simon Fraser University, Vancouver, Canada, "Antibiotics: The Twentieth-Century "Silver Bullets" and How They Are Being Tarnished", March 2007.
5. Reunion Weekend Lecture, University of Notre Dame, "Antibiotics: The Twentieth-Century "Silver Bullets" and How They Are Being Tarnished", June 2009.