

## CURRICULUM VITAE

### Gary L. Gilliland

Director, Structural Biology  
Centocor R&D, Inc.  
145 King of Prussia Road, Radnor, PA 19087

#### Education

Ph.D. 1979 Rice University, Houston, Texas, Biochemistry  
B.S. 1975 University of Idaho, Moscow, Idaho, Chemistry Major  
A.S. 1973 North Idaho College, Coeur D'Alene, Idaho

Thesis: The High Resolution Three-Dimensional Structure of the L-Arabinose-Binding Protein from *Escherichia coli*.

#### Research and Teaching Positions

Mar 2005 - present Director, Structural Biology, Centocor, Inc., Radnor, PA  
Mar 2002 – Sep 2003 Associate Director of the Center for Advanced Research in Biotechnology (CARB) of the National Institute of Standards and Technology (NIST) and the University of Maryland Biotechnology Institute, Rockville, MD  
Oct 1996 – Mar 2002 Chief, Biotechnology Division, Chemical Science and Technology Laboratory, National Institute of Standards and Technology, Gaithersburg, MD  
Jan 1994 – Jul 2007 Adjunct Professor, University of Maryland at Baltimore, School of Medicine, Department of Biochemistry & Molecular Biology, Baltimore, MD  
Sep 1991 – Dec 2004 Adjunct Professor, The George Washington University, Graduate Genetics Program, Washington, D.C.  
May 1991 - Oct 1996 Associate Director of the Center for Advanced Research in Biotechnology (CARB) of the National Institute of Standards and Technology (NIST) and the University of Maryland Biotechnology Institute, Rockville, MD  
Oct 1990 – Mar 2005 Adjunct Professor of the University of Maryland Biotechnology Institute, Rockville, MD  
Oct 1988 – Mar 2005 CARB Fellow, Center for Advanced Research in Biotechnology, National Institute of Standards and Technology, Rockville, MD  
Oct 1988 – Mar 2005 Research Chemist, CARB, Biotechnology Division, Chemical Science Technology Laboratory, National Institute of Standards and Technology, Rockville, MD  
Aug 1986 - Oct 1988 Research Chemist, Macromolecular Structure Section, Chemical Thermodynamics Division, Center for Chemical Physics, National Bureau of Standards, Gaithersburg, MD  
Aug 1985 - Aug 1986 Principle Research Scientist, Protein Engineering Department, Genex Corporation, Gaithersburg, MD  
Aug 1983 - Aug 1985 Senior Scientist, Physical Chemistry Department, Hoffmann-La Roche, Inc., Nutley, NJ  
May 1981 - Aug 1983 Senior Staff Fellow, Molecular Structure Section, Laboratory of Molecular Biology, National Institute of Arthritis, Diabetes, & digestive & Kidney Disease, National Institutes of Health, Bethesda, MD  
May 1979 - May 1981 Staff Fellow, Molecular Structure Section, Laboratory of Molecular Biology, National Institute of Arthritis, Diabetes, & Digestive & Kidney Disease, National Institutes of Health, Bethesda, MD  
Jun 1976 - Dec 1976 Predoctoral Research, Biochemistry Department, Rice University, Houston, TX  
Sep 1976 - Dec 1977 Teaching Assistant, Biochemistry Department, Rice University, Houston, TX  
Jun 1974 - May 1975 Undergraduate Research, Chemistry Department, University of Idaho, Moscow, ID

May 1972 - Aug 1972      Laboratory and Teaching Assistant, North Idaho College, Coeur D'Alene, ID

## Honors

U.S. Department of Commerce Silver Medal Award for Superior Federal Service (2002) *Management of the Protein Data Bank efforts at NIST*  
U.S. Department of Commerce Silver Medal Award for Superior Federal Service (1996) *Management of the NIST/UMBI Center for Advanced Research in Biotechnology*  
NIST, Chemical Science and Technology Laboratory, Technical Achievement Award (1994) *Protein Engineering of Subtilisin BPN' for Thermal Stability*  
U.S. Department of Commerce Bronze Medal Award for Superior Federal Service (1989) *Development of the Biological Macromolecule Crystallization Database*  
Phi Lambda Upsilon (1977)  
Welch Foundation Predoctoral Fellowship (1976-1979)  
Rice University Predoctoral Fellowship (1975-1976)  
Merck Index Award for Outstanding Student in Chemistry (1975)  
National Sciences Foundation Summer Undergraduate Research Scholarship (1974)  
Who's Who in American Junior Colleges (1973)  
Phi Theta Kappa (1973)

## Societies

American Crystallographic Association  
American Association for the Advancement of Science  
Protein Society

## Editorships

1998 – present      Associate Editor, *Proteins: Structure, Function, Bioinformatics*  
1997 – 2003      Associate Editor, *Biophysical Journal*  
1995 – 2004      Associate Editor, *Protein Peptide Letters*

## Advisory and Review Panels

2003 – present      Member, External Advisory Board, NIH Center of Biomedical Research Excellence (COBRE) in Protein Structure and Function, University of Kansas  
2004      NIH Special Emphasis Study Section ZRG1 BST-A (55) reviewed grant applications for National Centers for Biomedical Computing.  
2004      NIH Special Emphasis Study Section ZRG1 BST-C(50) reviewed grant applications related to data sharing and collaboration.  
2002 – 2003      Member, Department of Commerce Representative, Inter-Departmental Working Group for Laboratory Containment of Wild Polioviruses in the United States (in preparation for the eradication of this disease)  
2001 – 2003      Co-chairman of the Bioanalysis Working Group of the CCQM (Consultative Committee for Amount of Substance) of the Bureau International des Poids et Mesures.  
2001 - 2003      Member, NIH NCRR Shared Instrumentation Study Section  
2001      Member, NASA, Structural Biology Panel  
1985      Member, Scientific Advisory Panel for the First International Conference on the Crystallization of Biological Macromolecules, Stanford, CA.  
1988 - 1990      Member, NASA Science and Technology Working Group, Advanced Protein Crystal Growth.  
1998 - 2001      Member, SBIR Special Study Section 6C of the National Institutes of Health  
1998      Member, NSF Review Panel, Interagency Activity in Metabolic Engineering  
1997 - 2003      Member, Board of Directors, Council of Biotechnology Centers of the Biotechnology Industry Organization.

1997 – 2000	Member, United States National Committee for Crystallography
1997 – 2000	Representative to CODATA, International Union of Crystallography.
1996 – 2004	Member, ASTM Committee E-48 on Biotechnology
1996 - 2003	Member, Biotechnology Research Working Group of the Subcommittee on Biotechnology reporting to the Office of Science and Technology Policy.
1996 - 1999	Member, Database Committee, International Union of Crystallography.
1994	Member, Panel 3, Proteins I, review of Department of Energy OHER Research Projects in the Structural Biology Program.
1993	Member, NSF Committee of Visitors, reviewed the Biochemistry and Molecular Structure and Function Division of Molecular and Cellular Biosciences.
1992	Member (ad hoc), NIH Molecular and Cellular Biophysics Study Section (BBCA).
1992	Member, NIH Special Review Committee for program project grants in response to RFA entitled Structural Biology as Applied to the Problem of Targeted Drug Design, with Potential Applicability to the Treatment of Aids.
1992	Member, Biotechnology Research Initiative Working Group on Infrastructure reporting to the Biotechnology Research Subcommittee of the Congressional Committee on Life Sciences and Health.
1992	Reviewer (ad hoc), Brookhaven Protein Data Bank for DOE and NSF.
1991 - 2003	Member, Board of Overseers, Center for Advanced Research in Biotechnology of the University of Maryland Biotechnology Institute and the National Institute of Standards and Technology.
1991 - 1997	Member, SBIR Special Study Section 6C of the National Institutes of Health.
1991 - 1993	Member, Working Group on Structural Biology of the Biotechnology Research Subcommittee of the Congressional Committee on Life Sciences and Health.
1991 - 1993	Chairman, Biotechnology Working Group, an advisory panel for the NASA Microgravity Science and Applications Division.
1991 - 1993	Member, Microgravity Science and Applications Subcommittee of the Space Science and Applications Advisory Committee an advisory panel for the NASA Microgravity Science and Applications Division.

## Conferences and Workshops

- Organizer and Instructor, X-Ray Methods in Structural Biology, Chinese National Academy of Sciences, Beijing, April 30-May 15, 2008.
- Organizer and Instructor, X-Ray Methods in Structural Biology, a Cold Spring Harbor Laboratory Course, 11-24 October 1990, 10-23 October 1991, 9-22 October 1992, 13-26 October 1993, 13-26 October 1994, 13-26 October 1995, 14-27 October 1996; 14-27 October 1997; 14-27 October 1998; 13-26 October 1999; 11-24 October 2000, 12-25 October 2001; October 2002; October 2003; October 2004; October 2005; 16-31 October 2006; 15-31 October 2007; 13-28 October 2008.
- Steering Committee & Session Chairman, Information Science Standards to Enable Biomedical Research Workshop, Bethesda, MD, November 4-5, 2003.
- Session Chairman, Crystal Growth of Soluble and Membrane Macromolecules, XIX International Union of Crystallography Meeting, Geneva, Switzerland, August 7-15, 2002.
- Session Chairman, Structure Determination, Structural Biology and Structural Genomics/Proteomics Workshop, NIDA, NIH, Bethesda, MD, May 8-10, 2002.
- Session Chairman, High Throughput Crystallization, American Crystallography Association Annual Meeting, St. Paul, MN, July 22-27, 2000.
- Program Chairman, Eight International Conference on the Crystallization of Biological Macromolecules, Sandestin, FL, May 14-19, 2000.
- Session Chairman, 24<sup>th</sup> Aharon Katzir-Katchalsky Conference celebrating the 25<sup>th</sup> Anniversary of the Protein Data Bank and the 10<sup>th</sup> Anniversary of SwissProt, November 17-22, 1996.
- Co-chairman, American Crystallographic Association Transaction Symposium, Structural Informatics, St. Louis,

July 21 1996.

Organizer and Instructor, National Academy of Sciences-HHMI Workshop on Macromolecular Crystallography, Mexico City, 6-17 February, 1995. This workshop was part of a joint program between the USA and Mexico National Academies of Science sponsored by the Howard Hughes Medical Institute.

Discussion Leader, Workshop on Biological Resource Databases, Institute of Laboratory Animal Resources, National Research Council, Washington, D.C., 6-7 January, 1994.

Co-chairman, Mid-Atlantic Protein Crystallography Workshop, 8-10 June 1993 Johns Hopkins University, Baltimore, MD.

Co-chairman, Mid-Atlantic Protein Crystallography Workshop, 6-8 May 1992, CARB, Rockville, MD.

Co-chairman, Mid-Atlantic Protein Crystallography Workshop, 16-18 May 1991, CARB, Rockville, MD.

Co-chairman, 2nd Annual Siemens Area Detector User-Group Meeting, Scientific Focus: Methodologies for Frontier Crystallography, 4-6 February 1990, CARB, Rockville, MD

Co-chairman, Third International Conference on Crystallization of Biological Macromolecules, 13-19 August 1989, Washington, DC

## Publications

### Peer Reviewed Journal Articles

1. Luo, J., Teplyakov, A., Obmolova, G., Malia, T., Wu, S.J., Beil, E., Baker, A., Swenki-Underwood, B., Sweet, R., Gilliland, G.L. 2009. Structure of EMMPRIN N-Terminal Domain I: Dimerization Via  $\beta$ -Strand Swapping. *Proteins: Struct., Func., Bioinform.*, in press.
2. Teplyakov, A., Obmolova, G., Wu, S.-J., Luo, J., Kang, J., O'Neil, K., Gilliland, G.L. 2009. Epitope Mapping of Anti-IL-13 Neutralizing Antibody CNTO607. *J. Mol. Biol.*, **389**, 115-123
3. Thompson, L.C., Ladner, J.E., Codreanu, S.G., Harp, J., Gilliland, G.L., Armstrong, R.N. 2007. 2-Hydroxychromene-2-carboxylic Acid Isomerase: a Kappa Class Glutathione Transferase from *Pseudomonas putida*. *Biochemistry* **46**, 6710-6722.
4. Pechik, I., Yakovlev, S., Mosesson, M.W., Gilliland, G.L., Medved, L. 2006. Structural Basis for Sequential Cleavage of Fibrinopeptides upon Fibrin Assembly. *Biochemistry* **45**, 3588-3597.
5. Teplyakov, A., Obmolova, G., Sarikaya, E., Pullalarevu, S., Krajewski, W., Galkin, A., Howard, A.J., Herzberg, O., Gilliland, G.L. 2004. Crystal Structure of YgfZ Protein from *Escherichia coli* Suggests a Folate-Dependent Regulatory Role in One-Carbon Metabolism. *J. Bacteriol.* **186**, 7134-7140.
6. Ravichandran, V., Vasquez, G.B., Srivastava, S., Verma, M., Petricoin, E., Lubell, J., Sriram, R.D., Barker, P., Gilliland, G.L. 2004. Data Standards for Proteomics: Mitochondrial two-dimensional Polyacrylamide Gel Electrophoresis Data as a Model System. *Mitochondrion* **3**, 327-336.
7. Pechik, I., Madrazo, J., Mosesson, M.J., Hernandez, I., Gilliland, G.L. and Medved, L. 2004. Crystal Structure of the Complex between Thrombin and the Central 'E' Region of Fibrin. *Proc. Natl. Acad. Sci. USA* **101**, 2718-2723.
8. Ladner, J.E., Parsons, J.F., Rife, C.L., Gilliland, G.L., and Armstrong, R.N. 2004. Parallel evolutionary pathways for glutathione transferases: structure and mechanism of the mitochondrial class kappa enzyme rGSTK1-1. *Biochemistry* **43**, 352-361.
9. Teplyakov, A., Pullalarevu, S., Obmolova, G., Doseeva, V., Galkin, A., Herzberg, O., Dauter, M., Dauter, Z., and Gilliland, G.L. 2004. Crystal structure of the YffB protein from *Pseudomonas aeruginosa* suggests a glutathione-dependent thiol reductase function. *BMC Struct. Biol.* **4**, 5.
10. Ravichandran, V., Lubell, J., Vasquez, G.B., Lemkin, P., Siram, R.D., and Gilliland, G.L. 2004. Ongoing development of two-dimensional polyacrylamide gel electrophoresis data standards. *Electrophoresis* **25**, 297-308.
11. Khil, P.P., Obmolova, G., Teplyakov, A., Howard, A.J., Gilliland, G.L., Camerini-Otero, R.D. Crystal structure of the *Escherichia coli* YjiA protein suggests a GTP-dependent regulatory function. 2004. *Proteins: Struct. Func. Bioinform.* **53**, 371-374.
12. Rife, C.L., Parson, J.F., Xiao, G., Gilliland, G.L., and Armstrong, R.N. 2003. Conserved Structural Elements in Glutathione Transferase Homologs Encoded in the Genome of *Escherichia coli*. *Proteins: Struct. Func. Gen.* **53**, 777-782.

13. Ladner, J.E., Obmolova, G., Teplyakov, A., Howard, A.J., Khil, P.P., Camerini-Otero, R.D. and Gilliland, G.L. 2003. Crystal Structure of *Escherichia coli* Protein ybgI, a toroidal structure with a dinuclear metal site. *BMC Struct. Biol.* **3**, 7.
14. Teplyakov, A., Obmolova, G., Bir, N., Reddy, P., Howard, A.J., and Gilliland, G.L. 2003. Crystal structure of the YajQ protein from *Haemophilus influenzae* reveals a tandem of RNP-like domains. *J. Struct. Funct. Genomics* **4**, 1-9.
15. Teplyakov, A., Chu, S.Y., Obmolova, G., Toedt, J., Eisenstein, E., Howard, A.J., and Gilliland, G.L. 2003. Crystal Structure of the YchF protein, a putative GTP-dependent translation factor. *J. Bacteriol.* **185**, 4031-4037.
16. Obmolova, G., Teplyakov, A., Khil, P.P., Howard, A.J., Camerini-Otero, R.D., and Gilliland, G.L. 2003. Crystal structure of the *Escherichia coli* tas protein, an NADP(H)-dependent aldo-keto reductase. *Proteins: Struct. Funct. Gen.* **53**, 323-325.
17. Teplyakov, A., Obmolova, G., Khil, P.P., Howard, A.J., Camerini-Otero, R.D., and Gilliland, G.L. 2003. Crystal structure of the *Escherichia coli* YcdX protein reveals a trinuclear zinc active site. *Proteins: Struct. Funct. Gen.* **51**, 315-318.
18. Codreanu, S.G., Ladner, J.E., Xiao, G., Stourman, N.V., Hachey, D.L., Gilliland, G.L., and Armstrong, R.N. 2002. Local Protein Dynamics and Catalysis: Detection of Segmental Motion Associated with Rate-Limiting Product Release by a Glutathione Transferase. *Biochemistry* **41**, 15161-15172.
19. Almog, O., Gallagher, D.T., Ladner, J.E., Strausberg, S., Alexander, P., Bryan, P., and Gilliland, G.L. 2002. Structural Basis of Thermostability: Analysis of Stabilizing Mutations in Subtilisin BPN'. *J. Biol. Chem.* **277**, 27553-27558.
20. Westbrook, J., Feng, Z., Jain, S., Bhat, T.N., Thanki, N., Ravichandran, V., Gilliland, G.L., Bluhm, W., Weissig, H., Greer, D.S., Bourne, P.E., and Berman, H.M. 2002. The Protein Data Bank: Unifying the Archive. *Nucleic Acids Research*, **30**, 245-248.
21. Gilliland, G.L., Tung, M., and Ladner, J.E. 2002. The Biological Macromolecule Crystallization Database: Crystallization Procedures and Strategies. *Acta Crystallogr. D* **58**, 916-920.
22. Berman, H.M., Battistuz, T., Bhat, T.N., Bluhm, W.F., Bourne, P.E., Burkhardt, K., Feng, Z., Gilliland, G.L., Iype, L., Jain, S., Fagan, P., Marvin, J., Ravichandran, V., Schneider, B., Thanki, N., Padilla, D., Weissig, H., Westbrook, J.D., and Zardecki, C. 2002. The Protein Data Bank. *Acta Crystallogr. D* **58**, 899-907.
23. Teplyakov, A., Obmolova, G., Tordova, M., Thanki, N., Bonander, N., Eisenstein, E. Howard, A.J., and Gilliland, G.L. 2002. Crystal Structure of the YjeE Protein from *Haemophilus influenzae*: A Putative ATPase Involved in Cell Wall Synthesis. *Proteins: Struct. Funct. Genet.* **48**, 220-226.
24. Obmolova, G., Teplyakov, A., Bonander, N., Howard, A.J., and Gilliland, G.L. 2001. Crystal Structure of Dephospho-Coenzyme A Kinase. 2001. *J. Structural Biol.* **136**, 119-125.
25. Chu, S., Tordova, M., Gilliland, G.L., Gorshkova, I., Shi, Y., Wang, S., and Schwarz, F.P. 2001. The T127L/S12A Variant of CRP Facilitates Promoter Site Binding. *J. Biol. Chem.* **276**, 11230-11236.
26. Bhat, T.N., Bourne, P., Feng, Z., Gilliland, G., Jain, S., Ravichandran, V., Schneider, B., Schneider, K., Thanki, N., Weissig, H., Westbrook, J., and Berman, H.M. 2001. The PDB Data Uniformity Project. *Nucleic Acids Research* **29**, 214-218.
27. Berman, H.M., Bhat, T.N., Bourne, P.E., Feng, Z., Gilliland, G., Weissig, H., and Westbrook, J. 2000. The PDB and the Challenge of Structural Genomics. *Nature: Structural Biology* **11**, 957-959.
28. Rubinson, K. A., Ladner, J. E., Tordova, M., and Gilliland, G. L. 2000. Cryosalts: suppression of ice formation in macromolecular crystallography. *Acta Crystallogr. D* **56**, 996-1001.
29. Werner, R.M., Jiang, Y.L., Gordley, R.G., Jagadeesh, G.J., Ladner, J.E., Xiao, G., Tordova, M., Gilliland, G.L., and Stivers, J.T. 2000. Stressing-Out DNA? The Contribution of Serine-Phosphodiester Interactions in Catalysis by Uracil DNA Glycosylase. *Biochemistry* **39**, 12585-12594.
30. Ladner, J.E., Reddy, P., Davis, A., Tordova, M., Howard, A.J., and Gilliland, G.L. 2000 The 1.30 Å Resolution Structure of the *Bacillus subtilis* Chorismate Mutase Catalytic Homotrimer. *Acta Crystallogr. D* **56**, 673-683.
31. Berman, H.M., Westbrook, J., Feng, Z., Gilliland, G., Bhat, T.N., Weissig, H., Shindyalov, I.N., Bourne P.E. 2000. The Protein Data Bank. *Nucleic Acids Research* **28**, 235-242.

32. Drohat, A.C., Xiao, G., Tordova, M., Jagadeesch, J., Pankiewicz, K.W., Watanabe, K.A., Gilliland, G.L., and Stivers, J.T. 1999. Heteronuclear NMR and Crystallographic Studies of Wild-Type and H187Q *Escherichia coli* Uracil DNA Glycosylase: Electrophilic Catalysis of Uracil Expulsion by a Neutral Histidine 187. *Biochemistry* **38**, 11876-11886.
33. Vasquez, G.B., Ji, X., Pechik, I., Fronticelli, C., and Gilliland, G.L. 1999. Oxygen Binding to  $\alpha$ -Subunits in High-Salt Crystals of T-State Hemoglobin. *Prot. Pept. Lett.* **6**, 59-66.
34. Vasquez, G.B., Karavitis, M., Ji, X., Pechik, I., Brinigar, W.S., Gilliland, G.L., and Fronticelli, C. 1999. Cysteines  $\beta$ 93 and  $\beta$ 112 Probes of Conformational and Functional Events at the Human Hemoglobin Subunit Interfaces. *Biophysical Journal* **76**, 88-97.
35. Xiao, G., Tordova, M., Jagadeesh, J., Drohat, A.C., Stivers, J.T., and Gilliland, G.L. 1999. Crystal Structure of *Escherichia coli* Uracil DNA Glycosylase and Its Complexes with Uracil and Glycerol: Structure and Glycosylase Mechanism Revisited. *Proteins: Struct. Func. Gen.* **35**, 13-24.
36. Ladner, J.E., Abdulaev, G.N., Ladner, J.E., Kakuev, D.L., N.G., Karaschuk, Tordova, M., Eisenstein, E., Fujiwara, J.H., Gilliland, G.L., and Ridge, K. 1998. Three-Dimensional Structure of Two Isoforms of Nucleoside Diphosphate Kinase from Bovine Retina. *Acta Crystallogr. D* **55**, 1127-1135
37. Abdulaev, N.G., Karaschuk, G.N., Ladner, J., Kakuev, D.L., Yakhyaev, A.V., Tordova, M., Gaidarov, I.O., Popov, V.I., Fujiwara, J.H., Chinchilla, D., Eisenstein, E., Gilliland, G.L., and Ridge, K. 1998. Nucleoside Diphosphate Kinase from Bovine Retina. Purification, Subcellular Localization, Molecular Cloning, and Three-Dimensional Structure. *Biochemistry* **37**, 13958-13967.
38. Gallagher, D.T., Pan, Q. and Gilliland, G.L. 1998. Mechanism of Ionic Strength Dependence of Crystal Growth Rates in a Subtilisin Variant. *J. Crystal Growth* **193**, 665-673.
39. Xiao, G., Parsons, J.F., Tesh, K., Armstrong, R.N., and Gilliland, G.L. 1998. Conformational Changes in the Crystal Structure of Rat Glutathione Transferase M1-1 with Global Substitution of 3-Fluorotyrosine for Tyrosine. *J. Mol. Biol.* **281**, 323-339.
40. Wladkowski, B., Svensson, L.A., Sjölin, L., Ladner, J., and Gilliland, G.L. 1998. Structure (1.3 Å) and Charge States of a Ribonuclease A-Uridine Vanadate Complex: Implications for the Phosphate Ester Hydrolysis Mechanism. *JACS* **120**, 5488-5498.
41. Parson, J.F., Xiao, G., Gilliland, G.L., and Armstrong, R.N. 1998. Enzymes Harboring Unnatural Amino Acids. Mechanistic and Structural Analysis of the Enhanced Catalytic Activity of a Glutathione Transferase Containing 5-Fluorotryptophan. *Biochemistry* **37**, 6286-6294.
42. Gallagher, T., Eisenstein, E., Fisher, K., Zondlo, J., Chinchilla, D., Yu, H.D., Dill, J., Winborne, E., Ducote, K., Xiao, G., and Gilliland, G.L. 1998. Polymorphous Crystallization and Diffraction of Threonine Deaminase from *Escherichia coli*. *Acta Crystallogr. D* **54**, 467-469.
43. Chen, X., Tordova, M., Gilliland, G.L., Wang, L., Li, Y., Yan, H., and Ji, X. 1998. Crystal Structure of Cellular Retinoic Acid-Binding Protein Type II Suggests a Mechanism of Ligand Entry. *J. Mol. Biol.* **278**, 641-653.
44. Rodríguez-Romero, A., Almog, O., Tordova, M., Randhawa, Z., and Gilliland, G.L. 1998. Primary and Tertiary Structures of the Fab Fragment of a Monoclonal Anti-E-Selectin 7A9 Antibody Which Inhibits Neutrophil Attachment to Endothelial Cells. *J. Biol. Chem.* **273**, 11770-11775.
45. Vasquez, G., Ji, X., Fronticelli, C. and Gilliland, G.L. 1998. Human Carboxyhemoglobin at 2.2 Å Resolution: Structure and Solvent Comparisons of R-State R2-State and T-State Hemoglobins. *Acta Crystallogr. D* **54**, 355-366.
46. Gallagher, D.T., Gilliland, G.L., Xiao, G., Zondlo, J., Fisher, K.E., Chincilla, D., and Eisenstein, E. 1998. Structure and Control of Pyridoxal Phosphate-Dependent Allosteric Threonine Deaminase. *Structure* **6**, 465-475.
47. Almog, O., Benhar, I., Tordova, M., Pastan, I., and Gilliland, G.L. 1998. The Crystal Structure of the Disulfide-stabilized Fv Fragment of Anticancer Antibody B1: Conformational Influence of an Engineered Disulfide Bond. *Proteins: Struct. Func. Gen.* **31**, 128-138.
48. Almog, O., Gallagher, T.D., Tordova, M., Hoskins, J., Bryan, P., and Gilliland, G.L. 1998. Crystal Structure of Subtilisin BPN' Folded Without the Prodomain. *Proteins: Struct. Func. Gen.* **31**, 21-32.
49. Ji, X., Braxenthaler, M., Moulton, J., Fronticelli, C., Bucci, E., and Gilliland, G.L. 1998. Conformation of the

- Sebacyl  $\beta_1$ Lys82- $\beta_2$ Lys82 Crosslink in T-State Human Hemoglobin. *Proteins: Struct. Func. Gen.* **30**, 309-320.
50. Ji, X., Karavitis M., Razynska, A., Kwansa, H., Vasquez, G., Fronticelli, C., Bucci, E. and Gilliland, G.L. 1998.  $\alpha$ -Subunit Oxidation in T-State Crystals of a Sebacyl Crosslinked Human Hemoglobin with Unusual Autoxidation Properties. *Biophysical Chemistry* **70**, 21-34.
  51. Bujacz, G., Miller, M., Harrison, R., Thanki, N., Gilliland, G.L., Ogata, C.M., Kim, S.-H., and Wlodawer, A. 1997. The Structure of Monellin Refined at 2.3 Å Resolution in the Orthorhombic Crystal Form. *Acta Crystallogr. D* **53**, 713-719.
  52. Xiao, G., Parsons, J.F., Armstrong, R.N., and Gilliland, G.L. 1997. Crystal Structure of Tetradeca-(3-Fluorotyrosyl)-Glutathione Transferase. *JACS* **119**, 9325-9326.
  53. Ruvinov, S., Wang, L., Ruan, B., Almog, A., Gilliland, G.L., Eisenstein, E., and Bryan, P.N. 1997. Engineering the Independent Folding of the Subtilisin BPN' Prodomain: Analysis of Two-State Folding vs. Protein Stability. *Biochemistry* **36**, 10414-10421.
  54. Ji, X., Tordova, M., O'Donnell, R., Parsons, J.F., Hayden, J., Gilliland, G.L., and Zimniak, P. 1997. Structure and Function of the Xenobiotic Substrate Binding Site and Location of a Potential Non-Substrate Binding Site in a Pi Class Glutathione S-Transferase. *Biochemistry* **36**, 9690-9702.
  55. Ladner, J., Wladkowski, B., Svensson, L. A. , Sjölin, L. and Gilliland, G.L. 1997. The X-ray Structure of a Ribonuclease A-Uridine Vanadate Complex at 1.3 Å Resolution. *Acta Crystallogr. D* **53**, 290-301.
  56. Gallagher, T. and Gilliland, G.L. 1997. Water in Crystal Contacts: Retention of Bridging Waters, *Prot. Pept. Lett.* **4**, 81-86.
  57. Gallagher, T., Oliver, J., Betzel, C., Bott, R., and Gilliland, G.L. 1996. The Structure of Subtilisin BPN' at 1.6 Å Resolution: Analysis of Discrete Disorder and Comparison of Crystal Forms. *Acta Crystallogr. D* **52**, 1125-1135.
  58. Lubkowski, J., Palm, G.J., Gilliland, G., Derst, C., Rohm, K.-H., and Wlodawer, A. 1996. Crystal Structure and Amino Acid Sequence of *Wolinella succinogenes* L-Asparaginase. *Eur. J. Biochem.* **241**, 201-207.
  59. Gilliland, G.L., Tung, M., and Ladner, J. 1996. The Biological Macromolecule Crystallization Database and NASA Protein Crystal Growth Archive. *J. Res. Natl. Inst. Stand. Technol.* **101**, 309-320.
  60. Ji, X., von Rosenvinge, E.C., Johnson, W.W., Armstrong, R.N., and Gilliland, G.L. 1996. Location of a Potential Transport Binding Site in a Sigma Class Glutathione Transferase by X-ray Crystallography, *Proc. Natl. Acad. Sci. U.S.A.* **93**, 8208-8213.
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161. *Subtilisin Enzymes: Practical Protein Engineering*, edited by Richard Bott and Christian Betzel. New York: Plenum Press, 1996. Reviewed for *Proteins: Struct. Func. Genet.* (1997) **28**, 461-462.
162. Baker, E.N., Blundell, T.L., Vijayan, M., Dodson, E., Dodson, G., Gilliland, G.L., and Sussman, J.L. Diffraction Data Deposition. 1996. *Structure* **4**, 217.
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167. Baker, E.N., Blundell, T.L., Vijayan, M., Dodson, E., Dodson, G., Gilliland, G.L., and Sussman, J.L. Archival Journal Requirements of Macromolecular Crystallographic Data Deposition. 1996. *J. Biomol. Struct. Dyn.* **13**, 583.
168. Baker, E.N., Blundell, T.L., Vijayan, M., Dodson, E., Dodson, G., Gilliland, G.L., and Sussman, J.L. Crystallographic Data Deposition. 1996. *Nature*, **369**, 202.
169. *Crystallization of Biological Macromolecules. Proceedings of the Third International Conference on Crystallization of Biological Macromolecules, Washington D.C.* 1991. Published in the *Journal of Crystal Growth*, **Vol. 110**, North Holland, Edited by Ward, K.B., Gilliland, G.L., Bugg, C.E., Feigelson, R.S., Fonticella-Camps, J., Giege, R., McPherson, A., and Rosenberger, F.
170. Preparation and Analysis of Protein Crystals by Alexander McPherson, Wiley, New York, 1982. 371 pp. Reviewed for *Analytical Biochemistry* (1982) **127**, 459.

## Database Activities

### Biological Macromolecule Crystallization Database (1990-2005)

Developer of NIST Standard Reference Database 21: NIST/CARB Biological Macromolecule Crystallization Database (BMCD). The database system contains crystal data and the crystallization conditions of single crystals of all classes of protein and nucleic acid macromolecules.

1. Version 1.0: released in 1990.  
**User's Guide:** Gilliland, G.L., and Bickham, D.M., *NIST/CARB Biological Macromolecule Crystallization Database Version 1.0 User's Guide 1990*. U.S. Department of Commerce, National Institute of Standards and Technology, Standard Reference Data Program, Gaithersburg, MD.
2. Version 2.0: released in 1992.  
**User's Guide:** Gilliland, G.L., Tung, M.M., and Bickham, D.M., *NIST/CARB Biological Macromolecule Crystallization Database Version 2.0 User's Guide 1992*. U.S. Department of Commerce, National Institute of Standards and Technology, Standard Reference Data Program, Gaithersburg, MD.
3. Version 3.0: released in 1994 name changed to NIST/NASA/CARB Biological Macromolecule Crystallization Database.  
**User's Guide:** Ladner, J., Blakeslee, D.M., and Gilliland, G.L. *NIST/NASA/CARB Biological Macromolecule Crystallization Database Version 3.0 User's Guide 1994*. U.S. Department of Commerce, National Institute of Standards and Technology, Standard Reference Data Program, Gaithersburg, MD.
4. World Wide Web Version: originally released in 1995. The database is accessible via the URL address <http://wwwbmcd.nist.gov:8080/bmcd/bmcd.html>.

### Protein Data Bank

**Contributions to the Protein Data Bank (1980-2009):** 1APB, 6PTI, 7RSA, 8RSA, RSA, 1CMS, 4I1B, 1XIS, 2XIS, 3XIS, 4XIS, 21BI, 1GST, 31BI, 41BI, 1SUB, 1SUC, 1SUD, 2GST, 3GST, 4GST, 5GST, 1GUH, 1PGA, 1PGB, 1ENH, 1GNE, 2HHD, 2HHE, 1GSQ, 2GSQ, 1HDB, 1CLS, 1SPB, 1SUP, 1RUV, 1GBU, 1GBV, 6GST, 6GSU, 6GSV, 6GSW, 6GSX, 6GSY, 1IOB, 1WSA, 1XCA, 1AJ9, 1DSF, 5FWG, 3FYG, 4MON, 1PGT, 2PGT, 1SUA, 1A5F, 1A2Q, 1B4P, 1BE4, 1BHN, 1EUG, 2EUG, 3EUG, 4EUG, 5EUG, 1SUE, 1TDJ, 1DBF, 1FLZ, 1FL9, 1GNS, 1GNV, 1HTW, 1HW5, 1INO, 1J9A, 1JAL, 1JJV, 1JOP, 1JOS, 1JOV, 1LA9, 1LQA, 1M65, 1M68, 1MTC, 1N2A, 1NIJ, 1NMO, 1NMP, 1NRK, 1PBO, 1QVH, 4R4W, 1RW1, 1R45, 1RB4, 1Y7B, 1YI7, 1S4C, 2F6I, 2A45, 2IMD, 2IME, 2IMD, 2IME, 2IMF, 3G6A, 3G6D, 3I84, 3I85.

**The RCSB management of the Protein Data Bank (1998-2005):** The **Research Collaboratory for Structural Bioinformatics (RCSB)** is a non-profit consortium dedicated to improving our understanding of the function of biological systems through the study of the 3-D structure of biological macromolecules. RCSB

members work cooperatively and equally through joint grants and subsequently provide free public resources and publications to assist others and further the fields of bioinformatics and biology. **NIST, Rutgers University, and the San Diego Supercomputer Center at the University of California, San Diego** were the founding members of the RCSB, and staff at the three institutions put together the currently implemented plan to manage the Protein Data Bank. All sites maintain distribution sites for the PDB. NIST's site can be reached at <http://nist.rcsb.org/pdb/>.

**Role of NIST (1998-2005):** The NIST/CARB efforts have focused in the areas of data uniformity, developing relationship and data, production and distribution of the CD-ROM ftp archive (currently >1600 subscribers for the 10 disk set), disaster recovery, and establishing and maintain the physical archive (paper and electronic archive of all data transactions and activities of the Protein Data Bank).

### Invited Lectures

1. October 2008 - **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Maximizing Crystallization Success: Strategies and Seeding*
2. May 2008 - **Chinese National Academy of Sciences**, Beijing, China. *Maximizing Crystallization Success Through Seeding*.
3. May 2008 - **Chinese National Academy of Sciences**, Beijing, China. *Crystallization Strategies*.
4. October 2007 - **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Crystallization Strategies for Biological Macromolecules*.
5. October 2006 - **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Crystallization approaches of the Structure-2-Function Structural Genomics Project*.
6. October 2005 - **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Crystallization Databases and Strategies*.
7. October 2004 - **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *The Protein Data Bank*.
8. October 2004 - **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Crystallization Strategies and Databases*.
9. July 2004 – **Centocor, Malvern, PA**. *Assessing Protein Function from Three-Dimensional Structure*.
10. July 2003. **Bureau International des Poids et Mesures Metrology Summer School**. Severs, France. *Metrology of GM Foods*.
11. July 2003. **Bureau International des Poids et Mesures Metrology Summer School**. Severs, France. *DNA*.
12. July 2003. **Bureau International des Poids et Mesures Metrology Summer School**. Severs, France. *Biological Standards*.
13. April 2003. **Department of Biochemistry, Vanderbilt University**, Nashville, TN. *Structural Genomics: From Structure to Function*.
14. July 2003. **From Cloning to Crystallization Workshop. University of Kansas**, Lawrence, KA. *Biological Macromolecule Crystallization: Procedures and Strategies*.
15. October 2003 – **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Approaches to Crystallization Problems: Crystallization Data and Strategies*.
16. December 2002. **Department of Macromolecular Structure and Dynamics, Pacific Northwest National Laboratory**, Richland, WA. *Structural Genomics: From Structure to Function*.
17. October 2002. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *The Biological Macromolecule Crystallization Database: Crystallization Data and Strategies*.
18. September 2002. **System Biology Approach to Healthcare: Mitochondrial Proteomics Workshop**, NIST, Gaithersburg, MD. *Mitochondrial Proteomics: Developing the Measurements, Reference Materials, and Standards Infrastructure for Emerging Technologies*.
19. September 2002. **Institute for Reference Materials and Measurements Distinguished Lecture**, Geel, Belgium. *Biometrology: Developing the Measurements, Reference Materials and Standards Infrastructure for Emerging Technologies*.
20. September 2002. **EuroAnalysis XII**, Dortmund, Germany. *Biometrology: Developing the Measurements, Reference Materials and Standards Infrastructure for Emerging Technologies*.
21. August 2002. **XIX International Union of Crystallography Meeting**, Geneva, Switzerland. *The Biological*

- Macromolecule Crystallization Database: New Data, Crystallization Procedures and Strategies.*
22. May 2002. **Structural Genomics Informatics and Software Integration Workshop**, San Antonio, TX. *Structure2Function Laboratory Data Management.*
  23. April 2002. **CCQM (Consultative Committee for Amount of Substance) Workshop on Traceability** Bureau International des Poids et Mesures, France. *Towards Traceability in Bioanalysis.*
  24. October 2001. **Cold Spring Harbor Laboratory**. Cold Spring Harbor, NY. *Structural Genomics: From Structure to Function.*
  25. July 2001. **American Crystallographic Association Annual Meeting**. Los Angeles, CA. *Macromolecular Crystallography and Structural Biology Databases at NIST.*
  26. April 2001. **Bioinformatics and Biotechnology Program, Georgetown University**, Washington, D.C. *The Central Role of the Protein Data Bank in Bioinformatics.*
  27. April 2001. **CCQM (Consultative Committee for Amount of Substance)** Bureau International des Poids et Mesures, France. *Biometrology.*
  28. March 2001. **PittConn 2001**, New Orleans, LA. *The Central Role of the Protein Data Bank in Bioinformatics.*
  29. November 2000. **Crystallogenesi s Workshop**, Institute de Quimica, UNAM, Mexico City, Mexico. *Deposition and Querying the Protein Data Bank.*
  30. November 2000. **Crystallogenesi s Workshop**, Institute de Quimica, UNAM, Mexico City, Mexico. *Strategies Dealing with Crystallization Problems Encountered in High-Throughput Screening.*
  31. October 2000. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Depositing in and Querying the Protein Data Bank.*
  32. October 2000. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Structural Genomics: High-Throughput Crystallization.*
  33. July 2000. **American Crystallographic Association Annual Meeting**, St. Paul, MN. *Strategies for dealing with Problems Encountered in High-Throughput Crystallization.*
  34. July 2000. **2000 NCSL Workshop**, Toronto, Canada. *Biotechnology at NIST: Critical Measurements, Data and Standards for an Emerging Industry.*
  35. May 2000. **International Conference on the Crystallization of Biological Macromolecules VIII**, Sandestin, FL. *High-Throughput Crystallization for Structural Genomics.*
  36. February 2000. **Data Harvesting for Biomolecular NMR, EBI/CCPN Workshop**, Sanger Center, Hinxton, UK. *NMR and the PDB.*
  37. October 1999. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *The Protein Data Bank.*
  38. May 1999. **The Fifth International Meeting on Ribonucleases**, Warrenton, VA. *Ribonuclease A: Crystallographic Studies Probing the Structure, the Mechanism and the Early Events of Unfolding.*
  39. February 1999. **Biophysics Branch, NASA/Marshall Space Flight Center**, Huntsville, AL. *Protein Crystal Morphology Effects as Probes of Growth Chemistry.*
  40. February 1999. **21<sup>st</sup> Century Technology Workshop, National Security Study Group**, Alexandria, VA. *Biotechnology in 2025.*
  41. January 1999. **Frontiers of NMR in Molecular Biology VI, Keystone Symposium**, Breckinridge, CO. *NMR and the New Protein Data Bank.*
  42. October 1998. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Crystal Structure of Escherichia coli Uracil DNA Glycosylase and Its Complexes with Uracil and Glycerol: Structure and Glycosylase Mechanism Revisited.*
  43. May 1998. **7<sup>th</sup> International Conference on the Crystallization of Biological Macromolecules**, Granada, Spain. *Biological Macromolecule Crystallization Database.*
  44. February 1998. **Chemistry Department, University of Maryland**, College Park, MD. *Biotechnology.*
  45. January 1998. **Biochemistry Department, University of Maryland School of Medicine**, Baltimore, MD. *Crystal structure of Recombinant Tetradeca-(3-Fluorotyrosyl)-Glutathione S-Transferase.*
  46. October, 1997. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Crystal structure of Recombinant Tetradeca-(3-Fluorotyrosyl)-Glutathione S-Transferase.*
  47. July 1997. **American Crystallographic Association Transaction Symposium: Structural Informatics**, St. Louis, MO. *The Biological Macromolecule Crystallization Database.*

48. April, 1997. **Biomedical Technology & Bioengineering Symposium, National Science Foundation**, Arlington, VA. *NIST Biotechnology Research and ATP Programs.*
49. April, 1997. **Department of Chemistry, Rutgers University**, New Brunswick, NJ. *Ribonuclease A: Structure and Mechanism.*
50. March 1997. **Chemistry Department, University of Maryland**, College Park, MD. *Career Opportunities in Biotechnology.*
51. October, 1996. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Glutathione S-Transferase: Insight into Catalysis, Substrate Specificity and Subunit Interactions from Structural Analyses.*
52. October 1996. **Graduate Program in Genetics, The George Washington University**, Washington, D.C. *Protein Engineering Studies of Hemoglobin to Introduce Properties Desirable for Use in Blood Substitutes.*
53. September 1996-2004. **Department of Biochemistry and Molecular Biology, University of Maryland**, Baltimore, MD. (Graduate Course MBIC 701) *Protein Crystallography* (6 hours/year).
54. May 1996. **Biology Department, University of Maryland Baltimore County**, Baltimore, MD. *Structural Studies of Glutathione S-Transferase: Catalysis, Substrate Specificity, and Subunit Interactions.*
55. November 1995. **Department of Biochemistry, Bose Institute**, Calcutta, India. *Glutathione S-Transferase: Insight into Catalysis, Substrate Specificity and Subunit Interactions from Structural Analyses.*
56. November 1995. **Department of Biochemistry, Bose Institute**, Calcutta, India. *Biological Macromolecule Crystallization Database: Data and Tools for Developing Crystal Growth Strategies.*
57. November 1995. **International Seminar-Cum-School on Macromolecular Crystallographic Data, Saha Institute of Nuclear Physics**, Calcutta, India. *Glutathione S-Transferase: Insight into Catalysis, Substrate Specificity and Subunit Interactions from Structural Analyses.*
58. November 1995. **International Seminar-Cum-School on Macromolecular Crystallographic Data, Saha Institute of Nuclear Physics**, Calcutta, India. *Biological Macromolecule Crystallization Database: Data and Tools for Developing Crystal Growth Strategies.*
59. October, 1995. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Engineering of Subtilisin BPN' and Its Foldase Prosegment for Increased Thermal Stability, Calcium Independence, and Efficient Folding.*
60. September 1995. **Graduate Program in Genetics, The George Washington University**, Washington, D.C. *Protein Engineering Studies of Hemoglobin to Introduce Properties Desirable for Use in Blood Substitutes.*
61. August 1995. **NIST Workshop on Crystallographic Databases**, Gaithersburg, MD. *The Biological Macromolecule Crystallization Database.*
62. April 1995. **Center for Advanced Research in Biotechnology**, Rockville, MD. (1995 "State of the Art" Seminar Series). *X-ray Diffraction Techniques for the Study of Proteins of Physiological and Industrial Importance.*
63. April 1995. **Protein Engineering Network of Centers of Excellence, The University of Toronto**, Toronto, Canada. *The Development of Crystallization Strategies Using the Biological Macromolecule Crystallization Database.*
64. April 1995. **Protein Engineering Network of Centers of Excellence, The University of Toronto**, Toronto, Canada. *The Three-Dimensional Structure of Glutathione S-Transferase: The use of Site-Directed Mutagenesis to Study Catalysis and Substrate Specificity.*
65. February 1995. **Instituto de Química, Universidad Autónoma Nacional de México**, Mexico City, Mexico. *Crystallographic Studies of Glutathione S-Transferases.*
66. February 1995. **Instituto de Química, Universidad Autónoma Nacional de México**, Mexico City, Mexico. *Crystallization Strategies for Biological Macromolecules.*
67. July 1994. **XI Congress of the International Society for Artificial Cells, Blood Substitutes, and Immobilization Biotechnology**, Boston, MA. *Crystallographic and Structural Analysis Studies of Recombinant and Chemically Modified Hemoglobins Designed to Aid Development of Artificial Hemoglobin-Based Oxygen Carriers.*
68. May 1994. **Biochemistry Department, School of Medicine, Vanderbilt**, Nashville, TN. *The Three-Dimensional Structure of Glutathione S-Transferase: Crystallographic Analysis of Catalysis and Substrate Specificity.*
69. January 1994. **Biochemistry Department, University of Maryland School of Medicine**, Baltimore, MD.

*The Three-Dimensional Structure of Glutathione S-Transferase: Crystallographic Analysis of Catalysis and Substrate Specificity.*

70. January 1994. **Center for Microgravity and Materials Research, University of Alabama**, Huntsville, AL. *Crystallographic Studies of the Substrate Specificity and Mechanism of Class Mu Glutathione S-Transferase.*
71. October 1993. **Washington Crystal Colloquium**, Geophysical Laboratory, Washington, D.C. *The Active Site of Ribonuclease A: an Example of Solvent Modulated Specificity.*
72. October, 1993. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Ribonuclease A Revisited: Crystallographic Evidence for Solvent Modulated Pyrimidine Specificity and the High-Resolution Anisotropic Refinement at 1.04 Å Resolution.*
73. October, 1993. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Crystallographic Studies of the Enzymology and Substrate Specificity of Mu-Class Glutathione S-Transferase.*
74. September 1993. **Graduate Program in Genetics, The George Washington University**, Washington, D.C. *The Three-Dimensional Structure of Glutathione S-Transferase: The use of Site-Directed Mutagenesis to Study Catalysis and Substrate Specificity.*
75. August 1993. **The Fifth International Conference on Crystallization of Biological Macromolecules**, San Diego, CA. *The Biological Macromolecule Crystallization Database, Version 3.0: New Features, Data, and the NASA Archive for Protein Crystal Growth Data.*
76. May 1993. **Department of Biochemistry, University of Rome**, Rome, Italy. *Crystallographic Studies of the Catalytic Reaction of Glutathione S-Transferase.*
77. May 1993. **Ribonucleases: Chemistry, Biology, Biotechnology, Third International Meeting**, Capri, Italy. *The Active Site of Ribonuclease A: an Example of Solvent Modulated Specificity.*
78. May 1993. **Life Technologies, Inc.**, Rockville, MD. *Crystallographic Studies of Glutathione S-Transferase a Detoxification Enzyme.*
79. April 1993. **Protein Crystal Growth in Microgravity**, Panama City Beach, FL. *The Biological Macromolecule Crystallization Database and NASA Protein Crystal Growth Archive.*
80. April 1993. **Fifth Annual Siemens Area Detector User Group Meeting**, Braunschweig, Germany. *Crystallographic Studies of the Mechanism and Substrate Specificity of Class Mu Glutathione S-Transferase.*
81. January 1993. **The Maryland Biotechnology Annual Symposium**, Rockville, MD. *Crystallographic Studies of the Mechanism and Substrate Specificity of Class Mu Glutathione S-Transferase.*
82. October, 1992. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Crystal Structure Determinations and Analysis of Subtilisin BPN' Mutants in a Study of Thermal Stability.*
83. October, 1992. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *The 2.2 Å Three-Dimensional Structure of Glutathione S-Transferase from the mu Gene Class*
84. October 1992. **Graduate Program in Genetics, The George Washington University**, Washington, D.C. *The 2.2 Å Three-Dimensional Structure of Glutathione S-Transferase from the mu Gene Class.*
85. September 1992. **The International Conference on Subtilisin Proteases**, Hamburg, Germany. *Crystal Structure Analysis of Subtilisin BPN' Mutants Engineered for Studying Thermal Stability.*
86. September 1992. **Inorganic Chemistry and Biochemistry Departments, Chalmers University and University of Goteborg**, Goteborg, Sweden. *Crystal Structure Analysis of Subtilisin BPN' Mutants Engineered for Studying Thermal Stability.*
87. August 1992. **American Crystallographic Association Meeting**, Pittsburgh, PA. *The Biological Macromolecule Crystallization Database: An Update.*
88. November 1991. **American Chemical Society Southeast Regional Meeting**, Richmond, VA. *Ribonuclease A Complexed with Uridine Vanadate, a Transition-State Analog, at High Resolution.*
89. October, 1991. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *The Three-Dimensional Structure Determination of Isozyme 3-3 of a Glutathione S-Transferase from the Mu Gene Class.*
90. October, 1991. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Biological Macromolecule Crystallization Database: A Tool for the Development of Crystallization Strategies.*
91. August 1991. **Graduate Program in Genetics, The George Washington University**, Washington, D.C. *The functional Implications of the Three-Dimensional Structure of S-Glutathione Transferase.*
92. July 1991. **American Crystallographic Association Workshop: Macromolecular Crystallization,**

- University of Toledo, Toledo, OH. *Databases for Protein Crystallography*.
93. February 1991. **FAES Lecture series on Protein Structure-Function**, Bethesda, MD. *Protein Crystal Structure Determination*.
  94. March 1990. **Biochemistry Department, University of Maryland**, College Park, MD. *The Three-Dimensional Structure of Recombinant Chymosin and Its Relationships to Other Acid Proteinases*.
  95. October, 1990. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Conformational Flexibility of Surface Residues of Bovine Ribonuclease A at 1.0 Å Resolution*.
  96. October, 1990. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Three-Dimensional Structure of Recombinant Bovine Chymosin at 2.3 Å Resolution*.
  97. October, 1990. **Cold Spring Harbor Laboratory**, Cold Spring Harbor, NY. *Biological Macromolecule Crystallization Database: A Tool for the Development of Crystallization Strategies*.
  98. September 1990. **Aspartic Proteinase Conference**, Sonoma, CA. *Functional Implications of the Structure of Bovine Chymosin*.
  99. August 1990. **2nd International Meeting on Structure, Mechanism and Function of Ribonucleases**, Sant Feliu de Guixols, Spain. *The conformational flexibility of surface residues of bovine ribonuclease A at 1.0 Å resolution*.
  100. August 1990. **A Workshop on Desktop Molecular Visualization**, Bethesda, MD. *The Design of Crystallization Strategies Implementing the Biological Macromolecule Crystallization Database*.
  101. June, 1990. **Frontiers in Bioprocessing II**, Boulder CO. *Center for Advanced Research in Biotechnology: A Multidisciplinary Approach to Protein Engineering*.
  102. May, 1990. **New Developments in Protein Crystal Growth Workshop**, Gulf Shores, AL. *The Biological Macromolecule Crystallization Database: A Tool to Assist the Development of Crystallization Strategies*.
  103. January 1990. **FAES Lecture series on Protein Structure-Function**, Bethesda, MD. *Protein Crystallography*.
  104. April 1989. **The Maryland Biotechnology Annual Symposium**, Donald Brown Center, Port Deposit, MD. *The Three-Dimensional Structure of Recombinant Chymosin*.
  105. May 1989. **The Mid-Atlantic States Protein Crystallographic Conference**, The Johns Hopkins University  
March 1989. **Triton Biosciences, Inc.**, Alameda, CA. *Protein Structure Function Studies at CARB*.
  106. Medical School, Baltimore MD. *A Proposal for a Local Area Station at the Argonne Advanced Photon Source*.
  107. March 1989. **Genencor, Inc.**, South San Francisco, CA. *The Three-Dimensional Structure of Recombinant Chymosin*.
  108. July 1988. **The 18th Linderstrom-Lang Conference**, Elsinore, Denmark. *The Three-Dimensional Structure of Recombinant Bovine Chymosin at 2.3 Ångstrom Resolution*.
  109. June 1988. **The American Crystallographic Association Meeting**, Philadelphia, PA. *The Use of an Imaging Proportional Counter (IPC): Data Collection and Processing-A User's Observations*.
  110. December 1987. **Chemistry Department, University of Maryland**, College Park, MD. *A Strategy for Determining Protein Crystal Growth Conditions*.
  111. December 1987. **Chemistry Department, University of Maryland**, College Park, MD. *Techniques used for Protein Crystal Growth Experiments*.
  112. November 1987. **The Industrial Technical Information Mangers Group Meeting**, National Bureau of Standards, Gaithersburg, MD. *The NBS Crystallization Database*.
  113. July 1987. **Second International Meeting on Crystal Growth of Biological Macromolecules**, Bischenberg, France. *The NBS Biological Macromolecule Crystallization Database*.
  114. July 1987. **Chalmers University and University of Goteborg**, Goteborg, Sweden. Inorganic Chemistry Department. *Protein Engineering: A Thermal Stable Subtilisin*.
  115. April 1987. **Maryland Biotechnology Annual Symposium**, Donald Brown Center, Port Deposit, MD. *Protein Engineering of Subtilisin: additivity of single-site mutants-a crystallographic study*.
  116. March 1987. **Ben Taub Research Center, Howard Hughes Medical Institute, Baylor College of Medicine**, Houston, TX. *Protein Engineering of a More Thermal Stable Subtilisin*.
  117. March 1987. **The American Crystallographic Association Annual Meeting**, Austin, TX. *The*

*Implementation and Performance of the Nicolet Imaging Proportional Counters (IPC) at NBS and Genex Corporation.*

118. August 1986. **Biochemistry and Biophysics Department, Washington State University**, Pullman, WA. *X-ray Crystallographic Studies of Site-Directed Mutants of Subtilisin BPN'*.
119. July 1986. **Workshop on Methods in Oligonucleotide Site-Directed Mutagenesis**, Catholic University, Washington, D.C. *Protein Engineering*.
120. April 1986. **The Mid-Atlantic Protein Crystallography Meeting**, Gaithersburg, MD. *Multiple Conformations of Amino Acid Residues in Ribonuclease A*.
121. March 1985. **Genex-UCLA Symposium Protein structure, Folding and Design**, Keystone, CO. *The Crystallization of Biological Macromolecules*.
122. November 1984. **The Eastern Analytical Symposium**, New York, NY. *Protein Crystallography at Hoffmann-La Roche, Inc.*
123. March 1983. **Department of Chemistry, Swedish University of Agricultural Sciences**, Uppsala, Sweden. *Crystallization of Proteins*.
124. March 1983. **Inorganic Chemistry Department, Chalmers University and University of Goteborg**, Goteborg, Sweden. *Crystallographic Studies of Bovine Heart Creatine Kinase*.
125. May 1980. **The Mid-Atlantic Protein Crystallography Conference**, Charlottesville, VA. *Preliminary Crystallographic Investigation of a human IgM Fv with Interesting Binding Properties*.