

DEBBIE C. CRANS

- Business Address** Department of Chemistry
Colorado State University
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- Personal** Born in Copenhagen, Denmark; Married to Christopher R. Roberts; Children Patricia Crans Roberts (13), Gerri Marie Roberts (13) and Mia Crans Roberts (9)
- Professional Position** Professor, July 1, 1998 -.
Research areas involve: Biological, Bioinorganic, Bioorganic, Coordination and Mechanistic Chemistries.
- Research** My interest in the chemistry and biochemistry of transition metal compounds is tied to the use of metals in medicine. I am particularly interested in insulin enhancing effect of vanadium and other transition metal compounds, and applications of metals and other phosphorus compounds in cancer. A recent interest has been in lipids and colloid systems and lipid processing. This include studies of and application of colloidal systems. We have been studying the fundamental coordination chemistry and reactions of metal compounds in aqueous solution and other environments. Our solution studies are carried out using 1D and non-routine 2D multinuclear NMR, EPR, UV-vis, IR spectroscopy and magnetic methods.
- Education** HARVARD UNIVERSITY, Cambridge, Massachusetts 02138
Ph.D. in Chemistry, 1980-1985, Advisor: Dr. George M. Whitesides, Thesis: Methodology in Enzyme-Catalyzed Organic Synthesis: Glycerol Kinase Catalyzed Phosphorylations
- UNIVERSITY OF COPENHAGEN
H. C. Ørsted Institute, Copenhagen, Denmark
Cand. Scient. 1. part (BS) 1974-1978; Cand. Scient. 2. part (research) 1978-1980
- Postdoctoral Education** UNIVERSITY OF CALIFORNIA, LOS ANGELES, 1985-1986
Joint project with Orville L. Chapman and Paul D. Boyer. Research: Mechanistic Enzymology on F₁-ATP Synthase from Chloroplasts and Beef Heart.
- Professional Appointments** 1998-present Professor, Colorado State University
1999-2009 Program Chair, Division of Inorganic Chemistry, American Chemical Society
1991-1998 Associate Professor, Colorado State University
1987-1991 Assistant Professor, Colorado State University
1989-present Member of the Cell and Molecular Biology Program, Colorado State University
1986 Instructor (1 semester) University of California, Los Angeles
- Awards** Colorado State University Undergraduate Teaching, Research and Mentoring Award, 2004 - The 1st Vanadis, Award, 2003 - The Margaret Hazaleus Award for mentoring Women at Colorado State and in the field, 2001 - Japan Society of Promotion of Science Fellowship, 2000/2001 - The Humboldt Research Award, 1993-96 - Alfred P. Sloan Research Fellow Award, 1994 - Alberta Heritage Foundation Award, 1990-1992 - Eli Lilly Young Investigator Award, 1989-1994 - NIH FIRST Award, 1986-1987 - American Heart Junior Fellowship, Spring, 1980 - Fellowship awarded by the Egmond H. Petersens Fund, 1979-1980 - Scholarstipendium, University of Copenhagen, Denmark, 1976-1977 - Exchange Student Fellowship, Washington State University

Professional Service and Honors 2010 - Metals in Medicine, Gordon Conference Chair, 2010-2008 – Editorial Board *J. Biol. Chem.*, 2007 – present Editorial Board *Chemija*, 1999-2010 - Program Chair, Inorganic Division, American Chemical Society, 1997-1999 - Assistant Program Chair, Inorganic Division, American Chemical Society, 1996-2000 - Biophysical Biochemistry Study Section Member, 1996-1998 - Advisory Board for *Chemical and Engineering News*, 1993 - Ad hoc Reviewer NIH "Biophysical Biochemistry" Study Section, 1992-1993 - Nomination Committee, Div. of Biological Chemistry, American Chemical Society, 1992-1993 - Ad hoc Reviewer NIH "Biochemistry" Study Section, 1991 - International Faculty, Danish Research Academy, 2006, 2004, 2000, 1991 - NSF Panel Member for review of Various Grants, 1991 - Tenth NSF Workshop on Reactive Intermediates (WOR1), 1991-1994 - BRSO Panel Member for review of Colorado State University Research Grants, 1989 - Twentieth Annual NSF Workshop on Organic Synthesis and Natural Products Chemistry (WOSNPC - XX)

Publications (Selected from 137 in peer-reviewed journals; 15 additional publications):

13. "Reversible and in Situ Formation of Organic Arsenates and Vanadates as Organic Phosphate Mimics in Enzymatic Reactions: Mechanistic Investigation of Aldol Reactions and Synthetic Applications," D. G. Drueckhammer, J. R. Durrwachter, R. L. Pederson, D. C. Crans, L. Daniels and C-H. Wong, *J. Org. Chem.* **1989**, *54*, 70-7.
14. "Interaction of Trace Levels of Vanadium(IV) and (V) in Biological Systems," Debbie C. Crans, Robin L. Bunch and Lisa A. Theisen, *J. Am. Chem. Soc.* **1989**, *111*, 7597-607.
15. "Vanadate Tetramer as Inhibiting Species in Enzyme Reactions *in Vitro* and *in Vivo*," Debbie C. Crans, Ellen M. Willging and Steven K. Butler, *J. Am. Chem. Soc.* **1990**, *112*, 427-32.
18. "Time-Resolved ^{51}V 2-D NMR for Studies of Kinetic Exchange Between Vanadate Oligomers," Debbie C. Crans, Christopher D. Rithner and Lisa A. Theisen, *J. Am. Chem. Soc.* **1990**, *112*, 2901-8.
20. "A Cyclic Vanadium(V) Alkoxide – An Analog of the Ribonuclease Inhibitors," Debbie C. Crans, Robert A. Felty and Mary M. Miller, *J. Am. Chem. Soc.* **1991**, *113*, 265-9.
21. "Structural and Kinetic Characterization of Simple Complexes as Models for Vanadate – Protein Interactions in Aqueous Solution," Debbie C. Crans, Per Magnus Ehde, Paul K. Shin and Lage Pettersson, *J. Am. Chem. Soc.* **1991**, *113*, 3728-36.
24. "Inhibition of Human Seminal Fluid and *Leishmania donovani* Phosphatases by Molybdate Heteropolyanions," Asish K. Saha, Debbie C. Crans, Michael T. Pope, Carmen M. Simone and Robert H. Glew, *J. Biol. Chem.* **1991**, *266*, 3511-7.
25. "Vanadate Interactions with Bovine Copper, Zinc-Superoxide Dismutase as Probed by ^{51}V NMR Spectroscopy," Lisa Wittenkeller, Aida Abraha, Ravichandran Ramasamy, Duarte Mota de Freitas, Lisa A. Theisen and Debbie C. Crans, *J. Am. Chem. Soc.* **1991**, *113*, 7872-81.
27. "Synthesis and Reactivity of Oxovanadium(V) Trialkoxides of Bulky and Chiral Alcohols," Debbie C. Crans, Haojiang Chen and Robert A. Felty, *J. Am. Chem. Soc.* **1992**, *114*, 4543-50.
28. "Chemically Induced Modification of Cofactor Specificity of Glucose-6-Phosphate Dehydrogenase," Debbie C. Crans, Carmen M. Simone and John S. Blanchard, *J. Am. Chem. Soc.* **1992**, *114*, 4927-28.
29. "(-)-Cryptaustoline. Its Synthesis, Revision of Absolute Stereochemistry, and Mechanism of Inversion of Stereochemistry," Albert I. Meyers, Thais M. Sielecki, Debbie C. Crans, Robert W. Marshman and Thank Nguyen, *J. Am. Chem. Soc.* **1992**, *114*, 8483-9.
36. "Vanadium(V)-Protein Model Studies: Solid State and Solution Structure," Debbie C. Crans, Haojiang Chen; Oren P. Anderson; M. M. Miller, *J. Am. Chem. Soc.* **1993**, *115*, 6769-76.
40. "The X-ray Structure of $(\text{NH}_4)_6(\text{Gly-Gly})_2\text{V}_{10}\text{O}_{28}\cdot 4\text{H}_2\text{O}$: Model Studies of Polyoxometalate-protein Interactions," D. C. Crans, Mahroof-Tahir, M., Anderson, O. P., Miller, S. M., *Inorg. Chem.*, **1994**, *44*, 5586-90.
41. "Phytate Metabolism in Bean Seedlings during Post-Germinative Growth," Debbie C. Crans, Milos Mikus and Blayne R. Frieauf, *J. Plant Physiol.*, **1995**, *145*, 101-107.
48. "Organic Vanadium Compounds - Transition State Analogy with Organic Phosphorus Compounds," Debbie C. Crans, Anastasios D. Keramidis, Chryssoula Drouza, *Phosphorus, Sulphur, and Silicon* **1996**, *109-110*, 245-248.
50. "Evidence for Distinct Vanadyl(+4)-dependent Activating System for Manifesting Insulin-like Effects," Jinping Li, Gerard Elberg, Debbie C. Crans, and Yoram Shechter, *Biochemistry* **1996**, *35*, 8314-8318.

51. "Four- and Five-coordinate Oxovanadium(V) Alkoxides: Do Steric Effects or Electronic Properties Dictate the Geometry?," Jean Yves Kempf, Bernard Maignet, Debbie C. Crans, *Inorg. Chem.* **1996**, *35*, 6485-6494.
58. "Synthesis, Structure and Biological Activity of a New Insulinomimetic Peroxovanadium Compound: Bisperoxovanadium Imidazole Monoanion," Debbie C. Crans, Anastasios D. Keramidas, Helana Hoover-Litty, Oren P. Anderson, Mary M. Miller, Lynn M. Lemoine, Susan Pleasic-Williams, Mark Vandenberg, Anthony J. Rossomando, and Laurel Sweet, *J. Am. Chem. Soc.*, **1997**, *119*, 5447-5448. (erratum, 1997, 4461)
60. "Vanadium(V) Hydroxylamido Complexes: Solid State and Solution Properties," Anastasios D. Keramidas, Susie M. Miller, Oren P. Anderson and Debbie C. Crans, *J. Am. Chem. Soc.*, **1997**, *119*, 8901-8915.
62. "Metal-Carbohydrate Complexes in Solution," Jean-Francois Verchere, Stella Chapelle, Feibo Xin, and Debbie C. Crans, *Prog. Inorg. Chem.*, **1998**, *47*, 837-945.
67. "Stepwise Cluster Assembly Using VO₂(acac) as a Precursor: *cis*-[VO(OCH(CH₃)₂)(acac)₂], [V₂O₂(μ-OCH₃)₂(acac)₂(OCH₃)₂], [V₃O₃{μ,μ-(OCH₂)₃CCH₃]₂(acac)₂(OC₂H₅)], [V₄O₄(μ-O)₂(μ-OCH₃)₂(μ₃-OCH₃)₂(acac)₂(OCH₃)₂·2CH₃CN," Feilong Jiang, Oren P. Anderson, Susie M. Miller, John Chen, Mohammad Mahroof-Tahir and Debbie C. Crans, *Inorg. Chem.* **1998**, *37*, 5439-5451.
70. "Effects of Vanadium Complexes with Organic Ligands on Glucose Metabolism: A Comparison Study in Diabetic Rats," B. A. Reul, S. S. Amin, J. P. Buchet, L. N. Ongemba, D. C. Crans, and S. M. Brichard, *British J. Pharm.* **1999**, *126*, 467-477.
74. "Aqueous Chemistry of Ammonium Dipicolinatooxovanadium(V): The First Organic Vanadium(V) Insulin-Mimetic Compound," Debbie C. Crans, Luqin Yang, Tamas Jakusch and Tamas Kiss, *Inorg. Chem.* **2000**, *39*, 4409-4416.
75. "Methylation of Neutral Pseudotetrahedral Zinc Thiolate Complexes: Model Reactions for Alkyl Group Transfer to Sulfur by Zn-Containing Enzymes," Chris R. Warthen, Brain S. Hammes, Carl J. Carrano, Debbie C. Crans *J. Biol. Inorg. Chem* **2001**, *6*, 82-90.
78. "Cobalt(II) and Cobalt(III) Dipicolinate Complexes: Solid State, Solution and *in vivo* Insulin-like Properties," Luqin Yang, Debbie C. Crans,* Susie M. Miller, Agnete la Cour, Oren P. Anderson, Peter M. Kaszynski, Michael E. Godzala, III, LaTanya D. Austin and Gail R. Willsky *Inor. Chem.* **2002**, *41*, 4859-71.
81. "Inelastic neutron scattering on three mixed-valence dodecanuclear polyoxovanadate clusters," Reto Basler, Gregory Chaboussant, Andreas Sieber, Hanspeter Andres, Mark Murie, Paul Kögerler, Hartmut Bögge, Debbie C. Crans, Erich Krickemeyer, Stefan Janssen, Hannu Mutka, Achim Müller and Hans-Ulrich Güdel, *Inorg. Chem.* **2002**, *41*, 5675-85.
87. "Interaction of pyridine- and 4-hydroxypyridine-2,6-dicarboxylic acids with heavy metal ions in aqueous solutions," Norkus, Eugenijus; Stalioniene, Irena; Crans, Debbie C. *Heteroatom Chemistry* **2003**, *14*(7), 625-632
88. "The Membrane transport of vanadium compounds and the interaction with the erythrocyte membrane," Yang, Xiaogai, Wang, Kui, Lu, Jingfen, Crans, Debbie C. *Coord. Chem. Rev.* **2003**, *237*(1-2), 103-111.
89. "Applications of Paramagnetic NMR Spectroscopy for Monitoring Transition Metal Complex Stoichiometry and Speciation," Debbie C. Crans,* Luqin Yang, Ernestas Gaidamauskas, A. Raza Khan, Wenzheng Jin and Ursula Simonis, *ACS Symposium Series* **2003** 858, 304-32.
- 95 "Evidence of two-step deprotonation of mannitol in aqueous solution" Ernestas Gaidamauskas, Eugenijus Norkus, Jurate Vaiciuniene, Debbie C. Crans, Tapani Vuorinen, Jane Jaciauskiene, Gintaras Baltrunas, *Carbohydrate Res.* **2005**, *340*, 1553-1556.
98. "Aqueous Chemistry of the Vanadium^{III} and the V^{III}-Dipicolinate Systems and a Comparison of the Effect of Three Oxidation States of Vanadium Compounds on Diabetic Hyperglycemia in Rats", Péter Buglyó, Debbie C. Crans, Eszter M. Nagy, Ruby Lisa Lindo, Luqin Yang, Jason J. Smee, Lai-Har Chi, Michael E. Godzala III, and Gail R. Willsky, *Inorg. Chem.* **2005**, *44*, 5416-5427.
99. "Fifteen year of dancing with Vanadium" Debbie C. Crans, *Pure Appl. Chem.*, **2005**, *77*, 9, 1497-1527.
100. "Pulmonary Immunotoxic Potentials of Metals Are Governed by Select Physicochemical Properties: Chromium Agents." M.D. Cohen, M. Sisco, C. Prophete, L. Chen, J.T. Zelikoff, J.J. Smee, A.A. Holder, and D.C. Crans *J. of Immunotox.* **2006**, *3*, 69-81.
101. "Reduction of Vanadium(V) by L-Ascorbic Acid at Low and Neutral pH: Kinetic, Mechanistic and Spectroscopic Characterization" Patricia C. Wilkins, Michael D. Johnson, Alvin A. Holder, Debbie C. Crans, *Inorg. Chem.* **2006**, *45*, 1471-1479.
102. "Transition State Analogues for Nucleotidyl Transfer Reactions: Structure and Stability of Pentavalent Vanadate and Phosphate Ester Dianions" James Borden, Debbie C. Crans, Jan Florian *J. Phys. Chem. B* **2006**, *110*, 14988-14999.
103. "Molecule Probe Location in reverse Micelles Determined by NMR Dipolar Interactions" Debbie C. Crans, Christopher D. Rithner, Bharat Baruah, Bridget L. Gourley, Nancy E. Levinger, *J. Am. Chem. Soc.* **2006**, *128*, 4437-4445.
105. "Self-exchange Electron Transfer in High Oxidation State Non-oxo Metal Complexes: Amavadin" Jeremy Lenhardt, Bharat Baruah, Debbie C. Crans and Michael D. Johnson, *Chem. Comm.* **2006**, 4641-4643.

106. "Oxovanadates: a novel probe for studying lipid-water interfaces," Debbie C Crans, Bharat Baruah, Nancy E Levinger. *Biomedicine & Pharmacotherapy* 60(4), **2006**, 174-81.
108. "When water is not water? Exploring water confined in large reverse micelles using a highly charged inorganic molecular probe" Bharat Baruah, Jennifer M. Roden, Myles Sedgwick, N. Mariano Correa,† Debbie C. Crans,* and Nancy E. Levinger *J. Am. Chem. Soc.* **2006**, 128, 12758-765.
109. "Diabetes-altered gene expression in rat skeletal muscle corrected by oral administration of vanadyl sulfate," GR Willsky, LH Chi, Y Liang, DP Gaile, Z Hu, Debbie C. Crans. *Physiological Genomics* 26(3), **2006**, 192-201.
110. "Pulmonary Immunotoxic Potentials of Metals Are Governed by Select Physicochemical Properties: Vanadium Agents." M.D. Cohen, C. Prophete, M. Sisco, L. Chen, J.T. Zelikoff, J.J. Smee, A.A. Holder, A.J. Ghio, J.D. Stonehuerner, and D.C. Crans. *J. Immunotox.* 4(1), **2007**, 49-60.
115. "Chelation of Vanadium(V) by Difluoromethylene Bisphosphonate, a Structural Analog of pyrophosphate" Debbie C. Crans, Alvin A. Holder, Tapan Kumar Saha, G. K. Surya Prakash, Muhammed Yousufuddin, Roman Kultyshev, Rehana Ismail, Myron F. Goodman, James Borden, and Jan Florian **2007** *Inor. Chem.* **46**, 6723-6732.
116. "Investigating the vanadium environments in hydroxylamido V(V) dipicolinate complexes using ^{51}V NMR spectroscopy and density functional theory" Kristopher J. Ooms, Stephanie E. Bolte, Jason Smee, Bharat Baruah, Debbie C. Crans, Tatyana Polenova *Inor. Chem.* **2007** **46**, 9285-9293.
117. "4-Amino and 4-Nitrodipicolinovanadium(V) Complexes and Their Hydroxylamido Derivatives: Synthesis, Aqueous and Solid State Properties" Jason J. Smee, Jason A. Epps, Guillaume Teissedre, Mandy Maes, Nichola Harding, Luqin Yang, Bharat Baruah, Susie M. Miller, Oren P. Anderson, Gail R. Willsky, Debbie C. Crans *Inorg. Chem.* **2007** **46**, 9827-9840.
119. "Impairment of Ascorbates' Anti-Oxidant Properties in Confined Media: Inter and Intramolecular Reactions with Air and with Vanadate at Acidic pH" Debbie C. Crans, Bharat Baruah, Ernestas Gaidamauskas, Brant G. Lemons, Bret B. Lorenz, and Michael D. Johnson *J. Inorg. Biochem.* **2008**, 102, 1334-1347.
120. "Sarcoplasmic reticulum calcium ATPase is inhibited by organic vanadium coordination compounds" Manuel Aureliano, Fernando Henao, Teresa Tiago, Rui O. Duarte, J.J.G. Moura, Bharat Baruah and Debbie C. Crans, *Inor. Chem.* **2008**, **47**, 5677-5684.
122. " ^1H NMR studies of aerosol-OT reverse micelles with alkalin and magnesium counterions: preparation and analysis of MAOTs" Michelle L. Stahla, Bharat Baruah, Dustin M. James, Michael D. Johnson, Nancy E. Levinger and Debbie C. Crans *Langmuir*, **2008**, **24**, 6027-6035.
125. "Metal complexation chemistry used for phosphate and nucleotide determination: an investigation of the Yb^{3+} -pyrocatechol violet sensor" Ernestas Gaidamauskas, Kanokkarn Saejueng, Alvin A. Holder, Subalita Baruah, Boris A. Kashemirov, Debbie C. Crans and Charles E. McKenna *J. Biol. Inor. Chem.* **2008**, **13**, 1291-1299.
126. "Penetration of negatively charged lipid interfaces by the doubly deprotonated dipicolinate "Debbie C. Crans, Alejandro M. Trujillo, Sandra Bonetti, Christopher D. Rithner, Bharat Baruah, and Nancy E. Levinger *J. Org. Chem.* **2008**, **73**, 9633-9640.
127. "Inhibition of protein tyrosine phosphatase 1B and alkaline phosphatase by bis(maltolato)oxovanadium (IV)" M. Li, W. Ding, B. Baruah, D. C Crans, R. Wang *J. Inorg. Biochem.* **2008**, 102, 1846-1853.
128. "Deprotonation of b-cyclodextrin in alkaline solutions" Ernestas Gaidamauskas, Eugenijus Norkus, Eugenijus Butkus, Debbie C. Crans and Giedre Grinciene *Carbohydrate Research* **2009** **344**, 250-254.
130. "Decavanadate ($\text{V}_{10}\text{O}_{28}^{6-}$) and Oxovanadates: oxometalates with many biological activities" Manuel Aureliano and Debbie C. Crans *J. Inorg. Biochem.* **2009**, 103, 536-546.
131. "Chloro-Substituted Dipicolinate Vanadium Complexes: Synthesis, Solution, Solid-State and Insulin Enhancing Properties" Jason J. Smee, Jason A. Epps, Kristopher Ooms, Stephanie Bolte, Tatyana Polenova, Bharat Baruah, Luqin Yang, Wenjun Ding, Ming Li, Gail R. Willsky, Agnete la Cour, Oren P. Anderson, Debbie C. Crans *J. Inorg. Biochem.* **2009**, 103, 575-584.
136. " ^{51}V Solid-State NMR and Density Functional Theory Studies of Eight-Coordinate Non-Oxo Vanadium Complexes: Oxidized Amavadin" Kristopher J. Ooms, Stephanie E. Bolte, Bharat Baruah, Debbie C. Crans and Tatyana Polenova, *Dalton Transaction* **2009**, DOI: 10.1039/b820383k

Current Research Group:

Postdoctoral Fellows: Ernestas Gaidamauskas, Pabitra Chatterjee

Graduate Students: Myles Sedgwick, Alejandro M. Trujillo, Jackie Harding, Michelle Romanishan, and Samantha Shoerberl

Undergraduate Students: David Cleaver, Jessica Egner, Kelli Woll, Sarah Ward, Gyi Lee, Brandan Young

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