

CURRICULUM VITAE

LEON VINCENT KOCHIAN

Personal Data:

University Address: Robert W. Holley Center for Agriculture and Health
 USDA-ARS
 Cornell University
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Research Interests:

Using genomic, genetic and physiological approaches to improve the abiotic stress tolerance for staple food crops, especially for agriculture in developing countries. Molecular physiology and biophysics of mineral nutrient transport processes in plants; mechanisms and regulation of plant micronutrient transport; rhizosphere biology; role of root biology in plant responses to environmental stresses; cellular and molecular basis of aluminum toxicity and resistance in plants; mechanisms of heavy metal transport and resistance in plants; use of plants to remediate heavy metal-polluted soils.

Education:

1978: B.A. Botany, Highest Honors, University of California, Berkeley

Honors Research Thesis: "Hydrogen Evolution Catalyzed by Nitrogenase and Hydrogenases in Cultures of Cyanobacteria" Thesis Advisor: Dr. Russell Jones

1983: Ph.D. Plant Physiology, University of California, Davis.

Dissertation Title: "The Kinetics, Mechanisms and Localization of K⁺ Influx in *Zea mays* Roots"
 Major Professor: Dr. William J. Lucas

Professional Positions Held:

1978-82: NSF Doctoral Fellow, Botany Department, University of California, Davis
1982-83: UC Davis Graduate Fellow, Botany Department
1984-85: Postdoctoral Research Associate, Botany Department, University of California, Davis
1985: Lecturer, Botany Department, University of California, Davis
1985-Present: Plant Physiologist, USDA-ARS, U.S. Plant, Soil and Nutrition Laboratory, Ithaca, NY

- 1986-1990:** Assistant Professor (Adjunct), Section of Plant Biology, Cornell University
- 1987-1990:** Assistant Professor (Adjunct), Agronomy Department, Cornell University
- 1990-1998:** Associate Professor (Adjunct), Department of Soil, Crop and Atmospheric Sciences, Cornell University
- 1990-1998:** Associate Professor (Adjunct), Section of Plant Biology, Cornell University
- 1995-1998:** Associate Professor (Adjunct), Graduate Field of Environmental Toxicology, Cornell University
- 1997-2008:** Research Leader, USDA-ARS, U.S. Plant, Soil and Nutrition Laboratory, Cornell University, Ithaca, NY
- 1998-Present:** Professor (Adjunct), Department of Plant Biology, Cornell University
- 1998-Present:** Professor (Adjunct), Department of Crop and Soil Sciences, Cornell University
- 1998-Present:** Professor (Adjunct), Graduate Field of Environmental Toxicology, Cornell University
- 2008-Present:** Center Director, Robert W. Holley Center for Agriculture and Health, USDA-ARS, Cornell University

Teaching Experience:

- 1979-82:** Teaching Assistant for Botany 206A (Advanced Plant Physiology Laboratory; Prof. William J. Lucas)
- 1985** Lecturer (full-time) - Botany 205A, UC Davis
- 1987-Present** Instructor (full-time), BioPL/CSS 6420 - Mineral Nutrition: From Plants to Humans). Developed and teach this graduate course on plant mineral nutrition on a regular basis with Dr. Olena Vatamaniuk of CSS..
PLBR/BioPL/Hort 4070 - Nutritional Quality Improvement of Food Crops with Drs. Li Li and Ross Welch

Honors and Awards:

- Graduation with Highest Honors, BA in Botany, Univ of California, Berkeley, 1978.
- Outstanding Undergraduate in Botany; University of California, Berkeley, 1978.
- Phi Beta Kappa, University of California, Berkeley; 1978.
- National Science Foundation Predoctoral Fellowship; University of California, Davis; 1978 – 1982.
- Distinguished Scholar Research Award; University of California, Davis; 1978
- Earle C. Anthony Graduate Fellowship; University of California, Davis; 1982, 1983.
- Best Paper, American Society of Plant Physiologists, Western Section Meetings, Eugene, Oregon, 1981.
- ARS Administrator's Award, 1988, 1992, 1995, 1997
- USDA-ARS Early Career Scientist of the Year, 1990
- Secretary of Agriculture's National Award - Environmental Protection, 1999
- ARS National Scientist of the Year, 1999
- Promotion to ARS Supergrade, 2006

- Fellow of the American Society of Plant Physiology, 2007
- Fellow, American Association for the Advancement of Science (AAAS), 2008
- Presidential Rank Award, 2010. This award honors high-performing senior career employees of the US government for "sustained extraordinary accomplishment".

Membership in Professional Societies:

- American Society of Plant Biologists
- American Association for the Advancement of Science
- Sigma Xi
- Society for Experimental Biology (U.K.)
- New York Academy of Science
- American Society of Agronomy
- Editorial Board, *Plant Physiology*, 1990 - 1992, 1995-Present
- Editorial Board, *Plant and Soil*, 1994 - 2000
- Editorial Board, *Planta*, 1995- 2001
- USDA-NRI Competitive Grant Panel (Plant Responses to the Environment), 1992, 1994
- Panel Manager, Plant Responses to the Environment, USDA-NRI Competitive Grants Program, 1995
- Editorial Board, *Annual Review of Plant Physiology*, 1996-2001
- Executive Committee, American Society of Plant Biologists, 2009-present
- Chair, International Committee, American Society of Plant Biologists, 2009-present

Cornell Service

- I have served or are serving as Major Professor for 18 Ph.D. students (10 in Plant Biology, 3 in PLBR, 3 in CSS, 1 in Env. Toxicology, and 1 in BEE) and 1 MS student (CSS)
- I have served as a minor member on numerous Ph.D thesis committees in Plant Biology, SCAS, Fruit and Vegetable Crops, Natural Resources)
- I created and teach the graduate course in plant mineral nutrition (BioPL/CSS 6420 - Mineral Nutrition: From Plants to Humans).
- I co-teach PLBR/BioPL/Hort 4070 - Nutritional Quality Improvement of Food Crops with Drs. Li Li and Ross Welch
- I have taught a number of seminar courses in Plant Biology, as well as contributed to the team-taught Advanced Plant Physiology Lab (Bio Pl 643)
- I serve on the Cornell Genomics Task Force
- I have served on a number of *ad hoc* committees relating to genomics and biotechnology for Cornell, as well as on a number of faculty search committees in Plant Biology and Boyce Thompson Institute.

Publications:

1. Hallenbeck PC, LV Kochian, JC Weissman, and JR Benemann. 1978. Solar energy conversion with hydrogen-producing cultures of the blue-green alga, *Anabaena*

- cylindrica. *Biotechnology and Bioengineering* **8**: 283-297.
2. Hallenbeck PC, LV Kochian, and JR Benemann. 1981. Hydrogen evolution catalyzed by hydrogenase in cultures of cyanobacteria. *Zeit. Naturforsch* **36**: 87-92.
 3. Kochian LV, and WJ Lucas. 1982. Potassium transport in corn roots. I. Resolution of kinetics into a saturable and linear component. *Plant Physiol* **70**: 1723-1731.
 4. Kochian LV, and WJ Lucas. 1982. A reevaluation of the carrier-kinetic approach to ion transport in roots of higher plants. *What's New in Plant Physiology* **13**: 45-48.
 5. Kochian LV, and WJ Lucas. 1983. Potassium transport in corn roots. II. The significance of the root periphery. *Plant Physiol* **73**: 208-216.
 6. Kochian LV, and WJ Lucas. 1984. The significance of the linear component for K^+ influx in corn roots. In: Plant Membrane Transport, eds., WJ Cram, R Rybova, K Janacek. Academia, Publishing House of the Czechoslovak Academy of Science, Prague. pp. 410-411.
 7. Kochian LV, and WJ Lucas. 1985. Potassium transport in corn roots. III. Perturbation by exogenous NADH and ferricyanide. *Plant Physiol* **77**: 429-436.
 8. Kochian LV, J Xin-Zhi, and WJ Lucas. 1985. Potassium transport in corn roots. IV. Characterization of the linear component. *Plant Physiol* **79**: 771-776.
 9. Lucas WJ, and Kochian, LV. 1986. Ion transport processes in cornroots: An approach utilizing microelectrode techniques. In: Advanced Agricultural Instrumentation. eds., W Gensler, M Nijhoff, The Hague. pp. 402-425.
 10. Newman IA, LV Kochian, MA Grusak, and WJ Lucas. 1987. Fluxes of H^+ and K^+ in corn roots: Characterization and stoichiometries using ion-selective microelectrodes. *Plant Physiol* **84**: 1177-1184.
 11. Kochian LV, and Lucas, WJ. 1987. Investigating root ion transport processes: An integrated experimental approach. In: Electron Transfer Constituents of the Eukaryotic Plasma Membrane. ed. JM Ramirez, Spanish Research Council, Madrid. pp. 155-173.
 12. Lucas WJ, and Kochian, LV. 1987. Influence of exogenous NADH on K^+ and H^+ transport in corn roots. In: Electron Transfer Constituents of the Eukaryotic Plasma Membrane. ed. JM Ramirez, Spanish Research Council, Madrid. pp. 175-193.
 13. Kochian LV, and WJ Lucas. 1988. Potassium transport in roots. In: Advances in Botanical Research, Vol. 15. CA Callow and HW Woolhouse, eds. Academic Press, London, pp 93-178.
 14. Lucas WJ, and LV Kochian. 1988. Mechanisms of ion transport in plants: K^+ as an

- example. In: Plasma Membrane Oxidoreductases in Control of Animal and Plant Growth, eds. FL Crane, H Löw, and DJ Moore, Plenum Press, New York, pp. 219-232.
15. Kochian LV, JE Shaff, and WJ Lucas. 1989. High-affinity K^+ uptake in maize roots: A lack of coupling with H^+ efflux. *Plant Physiol* 91:1202-1211.
 16. DiTomaso JM, JE Shaff, and LV Kochian. 1989. Putrescine-induced wounding and its effect on membrane integrity and ion transport processes in roots of intact corn seedlings. *Plant Physiol* 90: 988-905.
 17. Miyasaka SC, LV Kochian, JE Shaff, and CD Foy. 1989. Mechanisms of aluminum tolerance: An investigation of genotypic differences in rhizosphere pH, potassium and proton fluxes, and membrane potentials. *Plant Physiol* 91: 1188-1196.
 18. Grusak, MA, RM Welch, and LV Kochian. 1989. A transport mutant for the study of iron absorption in plants. *Plant Membrane Transport: The Current Position*. J. Dainty, M.I. deMichelis, E. Marre, and F. Rasi-Caldogno, (eds.), Elsevier Press, Amsterdam, pp. 61-66.
 19. Kochian LV, IA Newman, and WJ Lucas. 1990. Ion transport in corn roots: Localized stoichiometries for H^+ , K^+ , and Cl^- . In: Membrane Transport in Plants and Fungi. M.J. Beilby, N.A. Walker, J.R. Smith, eds. University of Sydney Press, Sydney, Australia, pp. 119-123.
 20. Grusak, MA, LV Kochian, and RM Welch. 1990. A transport mutant of pea (*Pisum sativum*) for the study of iron absorption in higher plant roots. In: Plant Nutrition - Physiology and Applications. M.L. van Beusichem, ed. Kluwer Academic Publishers, pp. 219-222.
 21. McClure PR, LV Kochian, RM Spanswick, and JE Shaff. 1990. Evidence for cotransport of nitrate and protons in maize roots. I. Response of the root-cell membrane potential to nitrate. *Plant Physiol* 93: 281-289.
 22. McClure PR, LV Kochian, RM Spanswick, and JE Shaff. 1990. Evidence for cotransport of nitrate and protons in maize roots. II. Measurement of NO_3^-/H^+ fluxes with ion-selective microelectrodes. *Plant Physiol* 93: 290-294.
 23. Grusak MA, RM Welch, and LV Kochian. 1990. Physiological characterization of a single-gene mutant of *Pisum sativum* exhibiting excess iron accumulation. I. Root iron reduction and iron uptake. *Plant Physiol* 93: 976-981.
 24. Grusak MA, RM Welch, and LV Kochian. 1990. Does iron deficiency enhance the activity of the root-cell plasmalemma iron transport protein? *Plant Physiol* 94: 1353-1357.
 25. DiTomaso, JM and LV Kochian. 1991. Putrescine transport in roots of intact maize seedlings: Kinetic analyses, compartmentation, and involvement in metabolism. In:

Polyamines and Ethylene: Physiology, Biochemistry, and Interactions, pp. 48-51.

26. DiTomaso JM, PH Brown, AE Stowe, DL Linscott, and LV Kochian. 1991. Effects of diclofop and diclofop-methyl on membrane potentials in roots of intact oat, maize, and pea seedlings. *Plant Physiol* 95: 1063-1069.
27. Kochian, LV. 1991. Mechanisms of micronutrient uptake and translocation in plants. In: Micronutrients in Agriculture, Second Edition, JJ Mortvedt, FR Cox, LM Shuman, and RM Welch, eds., Soil Science Society of America, Madison, WI, pp. 229-296.
28. Kochian, LV and WJ Lucas. 1991. Do plasmalemma oxidoreductases play a role in plant mineral ion transport? In: Oxidoreductases at the Plasma Membrane: Relation to Growth and Development; Volume Plants, FL Crane, DJ Morre and H Low, eds., CRC Press, Boca Raton, pp 189-205.
29. Kochian, LV and JE Shaff. 1991. Investigating the relationship between aluminum toxicity, root growth, and root-generated ion currents. In: Plant-Soil Interactions at Low pH, RI Wright, VC Baligar, RP Murrmann, eds., Kluwer Academic Publishers, Netherlands, pp 769-778.
30. Kochian, LV, JE Shaff, and PR Ryan. 1991. Microelectrode-based investigations into the relationship between Al toxicity and root-cell membrane transport processes. *Current Topics in Plant Biochem Physiol*, 10: 117-133.
31. Anderson, JA, SS Huprikar, LV Kochian, WJ Lucas, and RF Gaber. 1992. Functional expression of a probable *Arabidopsis thaliana* potassium channel in *S. cerevisiae*. *Proc. Natl. Acad. Sci. USA* 89: 3736-3740.
32. Huang, JW, JE Shaff, DL Grunes, and LV Kochian. 1992. Al effects on calcium fluxes at the root apex of Al-tolerant and Al-sensitive wheat cultivars. *Plant Physiology* 98:230-237.
33. DiTomaso, JM, JJ Hart, and LV Kochian. 1992. Transport kinetics and metabolism of exogenously applied putrescine in roots of intact maize seedlings. *Plant Physiology* 98:611-620.
34. Ryan, PR, JE Shaff, and LV Kochian. 1992. Aluminum toxicity in roots: Correlation between ionic currents, ion fluxes and root elongation in Al-sensitive and Al-tolerant wheat cultivars. *Plant Physiol* 99: 1193-1200.
35. Glass, ADM, JE Shaff, and LV Kochian. 1992. Studies of the uptake of nitrate in barley. 4. Electrophysiology. *Plant Physiol* 99: 456-463.
36. DiTomaso, JM, JJ Hart, DL Linscott and LV Kochian. 1992. Effect of inorganic cations and metabolic inhibitors on putrescine transport in roots of intact maize seedlings. *Plant Physiol* 99: 508-514.

37. Kinraide, TB, PR Ryan, and LV Kochian. 1992. Interactive effects of Al^{3+} , H^+ , and other cations on root elongation considered in terms of cell-surface electrical potential. *Plant Physiol* 99: 1461-1467.
38. Lauver, TL, DC McCune, JE Shaff, and LV Kochian. 1992. The use of ion-selective microelectrodes for measuring calcium and hydrogen ion transfer between foliar surfaces and simulated rain solutions. *New Phytol* 121: 179-185.
39. Hart, JJ, JM DiTomaso, DL Linscott, and LV Kochian. 1992. Transport interactions between paraquat and polyamines in roots of intact maize seedlings. *Plant Physiol* 99: 1400-1405.
40. Huang, JW, DL Grunes, and LV Kochian. 1992. Aluminum effects on the kinetics of calcium uptake into cells of the wheat root apex. Quantification of calcium fluxes using a calcium-selective vibrating microelectrode. *Planta* 188: 414-421.
41. Kochian, LV, JE Shaff, W Kühtreiber, LF Jaffe, and WJ Lucas. 1992. Use of an extracellular vibrating ion-selective microelectrode system for the quantification of K^+ , H^+ and Ca^{2+} fluxes in maize roots and maize suspension cells. *Planta* 188: 601-610.
42. Welch, RM and LV Kochian. 1992. Regulation of iron accumulation in food crops: Studies using single gene pea mutants. In: Biotechnology and Nutrition: Proceedings of the Third International Symposium, DD Bills, S-D Kung, eds., Butterworth-Heinemann, Boston, pp. 325-344.
43. Hart, JJ, JM DiTomaso, DL Linscott, and LV Kochian. 1992. Characterization of the transport and cellular compartmentation of paraquat in intact maize seedlings. *Pest Biochem Physiol* 43: 212-219.
44. Zobel RW, LV Kochian, and TG Toulemonde. 1993. Plant root systems. *Proceedings of Roots of Plant Nutrition Conference*, Potash and Phosphate Institute, pp. 30-40.
45. Ryan, PR, JM DiTomaso, and LV Kochian. 1993. Aluminum toxicity in roots. An investigation of spatial sensitivity and the role of the root cap. *J Exp. Bot* 44: 437-446.
46. Grusak MA, LV Kochian, and RM Welch. 1993. Spatial and temporal development of iron(III) reductase activity in root systems of *Pisum sativum* L. challenged with iron-deficiency stress. *Am J Bot* 80: 300-308.
47. Huang JW, DL Grunes, and LV Kochian. 1993. Aluminum effects on calcium ($^{45}\text{Ca}^{2+}$) translocation in aluminum-tolerant and aluminum-sensitive wheat cultivars. Differential responses of the root apex versus mature root regions. *Plant Physiol* 102: 85-93.
48. Hart JJ, JM DiTomaso, DL Linscott, and LV Kochian. 1993. Investigations into the cation specificity and metabolic requirements for paraquat transport in roots of intact

- maize seedlings. *Pest Biochem Physiol* 45: 62-71.
49. Huang JW, DL Grunes, and LV Kochian. 1993. Aluminum effects on ⁴⁵calcium-labeled calcium uptake and translocation in wheat forages. *Agron J* 85: 867-873.
 50. Welch, RM, Norvell WA, Schaefer SS, Shaff JE and LV Kochian. 1993. Induction of iron(III) and copper(II) reduction in pea (*Pisum sativum* L.) roots by Fe and Cu status: Does the root-cell plasmalemma Fe(III) chelate reductase perform a general role in regulating cation uptake? *Planta* 190: 555-561.
 51. Ryan, PR, and LV Kochian. 1993. Aluminum differentially inhibits uptake into the root apex of near-isogenic lines of wheat: A possible mechanism of toxicity. *Plant Physiol* 102: 975-982.
 52. DiTomaso, JM, JJ Hart, and LV Kochian. 1993. Compartmentation analysis of paraquat fluxes in maize roots as a means of estimating the rate of vacuolar accumulation and translocation to shoots. *Plant Physiol* 102: 467-472.
 53. Ryan, PR, TB Kinraide, LV Kochian. 1993. Al³⁺-Ca²⁺ interactions in aluminum rhizotoxicity. I. Inhibition of root growth is not caused by reduction of calcium uptake. *Planta* 102: 98-103.
 54. Kinraide, TB, PR Ryan, LV Kochian. 1993. Al³⁺-Ca²⁺ interactions in aluminum rhizotoxicity. II. Evaluating the Ca²⁺ displacement hypothesis. *Planta* 102: 104-108.
 55. Norvell WA, RM Welch, ML Adams and LV Kochian. 1993. Reduction of Fe(III), Mn(II) and Cu(II) chelates by roots of pea (*Pisum sativum* L.) or soybean (*Glycine max*). In: *Plant Nutrition - From Genetic Engineering To Field Practice*, NJ Barrow, ed., Kluwer Academic Publishers, pp. 129-132.
 56. Kochian LV, DF Garvin, JE Shaff, TC Chilcott, and WJ Lucas. 1993. Towards an understanding of the molecular basis of plant K⁺ transport: characterization of cloned K⁺ transport cDNAs. In: *Plant Nutrition - From Genetic Engineering To Field Practice*, NJ Barrow, ed., Kluwer Academic Publishers, pp. 121-124.
 57. Hart JJ, JM DiTomaso, and LV Kochian. 1993. Characterization of paraquat transport in protoplasts from maize (*Zea mays* L.) suspension cells. *Plant Physiol* 103: 963-969.
 58. Dotray, PA, JM DiTomaso, JW Gronwald, DL Wyse, and LV Kochian. 1993. Effects of acetyl-coenzyme A carboxylase inhibitors on root cell transmembrane electric potentials in sethoxydim-tolerant and -susceptible corn. *Plant Physiol* 103: 919-924.
 59. Kochian LV. 1993. Zinc absorption from hydroponic solutions by plant roots. In: *Zinc in Soils and Plants*, AD Robson, ed., Kluwer Academic Publishers, pp. 45-57.
 60. Kochian LV, DF Garvin, JE Shaff, TC Chilcott, and WJ Lucas. 1993. Towards an

- understanding of the molecular basis of plant K^+ transport: characterization of cloned K^+ transport cDNAs. *Plant Soil* 155/156: 115-118
61. Grunes DL, Ohno T, Huang JW and Kochian LV. 1994. Effects of aluminum on magnesium, calcium and potassium in wheat forages. In *Magnesium 1993*. S Golf, D Dralle and L Vecchiet, eds., John Libbey and Company, Ltd., pp. 79-88.
 62. Huang JW, DL Grunes, and LV Kochian. 1994. Calcium transport in right-side-out plasma membrane vesicles isolated from wheat roots. Characterization of a voltage-gated calcium channel. *Proc Nat Acad Sci USA* 91: 3473-3477.
 63. Wang MY, ADM Glass, JE Shaff and LV Kochian. 1994. Ammonium uptake by rice roots. III. Electrophysiology. *Plant Physiol* 104: 899-906.
 64. Kochian LV, Jones DL and Shaff JE. 1994. The role of ion transport processes in root hair tip growth in *Limnobium stoloniferum*. In: *Pollen-Pistil Interactions and Pollen Tube Growth*, AG Stephenson, T-H Kao, eds., American Society of Plant Physiologists, pp. 150-160.
 65. Kochian LV. 1995. Cellular mechanisms of aluminum toxicity and resistance in plants. *Annu Rev Plant Physiol Plant Mol Biol* 46: 237-260.
 66. Huang JW, DL Grunes and LV Kochian. 1995. Aluminum and calcium transport interactions in intact roots and root plasmalemma vesicles from aluminum-sensitive and tolerant wheat cultivars. *Plant Soil* 171: 131-135.
 67. Pellet DM, DL Grunes and LV Kochian. 1995. Organic acid exudation as a mechanism of Al-tolerance in *Zea mays*. *Planta* 197: 788-795.
 68. Chilcott TC, S Frost-Shartzner, MW Iverson, DF Garvin, LV Kochian and WJ Lucas. 1995. Potassium transport kinetics of *KATI* expressed in *Xenopus* oocytes: A proposed molecular structure and field effect mechanism for membrane transport. *C.R. Acad. Sci. Paris, Life Sciences* 318: 761-771.
 69. Jones DL, JE Shaff and LV Kochian. 1995. Role of calcium and other ions in directing root hair tip growth in *Limnobium stoloniferum*. I. Inhibition of tip growth by aluminum. *Planta* 197: 672-680.
 70. Jones DL and LV Kochian. 1995. Aluminum inhibition of the $Ins(1,4,5)P_3$ signal transduction pathway in wheat roots: A role in aluminum toxicity? *The Plant Cell* 7: 1913-1922.
 71. Huang JW, D Pellet and LV Kochian. 1995. Aluminum interactions with voltage-dependent calcium transport in plasma membrane vesicles derived from roots of Al-sensitive and resistant wheat cultivars. *Plant Physiol* 110: 561-569.

72. Larsen PB, Tai C-Y, Kochian LV, Howell SH. 1995. Arabidopsis mutants with increased sensitivity to aluminum show altered aluminum accumulation and toxicity responses. *Plant Physiol* 110: 743-751
73. Lasat MM, JM DiTomaso, JJ Hart and LV Kochian. 1996. Resistance to paraquat in *Hordeum glaucum* is temperature dependent and not associated with enhanced apoplasmic binding. *Weed Res* 36: 303-309.
74. Fox TC, JE Shaff, MA Grusak, WA Norvell, Y Chen, RL Chaney and LV Kochian. 1996. Direct measurement of ^{59}Fe -labeled Fe^{2+} influx in roots of *Pisum sativum* using a chelator buffer system to control free Fe^{2+} in solution. *Plant Physiol* 111: 93-100.
75. Jones DL, PR Darrah and LV Kochian. 1996. Critical evaluation of organic acids mediated iron dissolution in the rhizosphere and its potential role in root iron uptake. *Plant Soil* 180: 57-66.
76. Pellet, DM, LA Papernik, Kochian LV. 1996. Multiple aluminum resistance mechanisms in wheat: The role of root apical phosphate and malate exudation. *Plant Physiology* 112: 591-597.
77. Romera FJ, RM Welch, WA Norvell, SC Schaefer and LV Kochian. 1996. Ethylene involvement in the overexpression of Fe(III)-chelate reductase by roots of *E107* pea [*Pisum sativum* L. (*brz,brz*)] and *chloronerva* tomato (*Lycopersicon esculentum* L.) mutant genotypes. *BioMetals* 9: 38-44.
78. Jones DL and LV Kochian. 1996. Aluminum-organic acid interactions in acid soils. I. Effect of root derived organic acids on the kinetics of Al dissolution. *Plant Soil* 182: 221-228.
79. Jones DL, AM Probowo and LV Kochian. 1996. Aluminum-organic acid interactions in acid soils. II. Influence of solid phase sorption on organic acid-Al complexation and Al rhizotoxicity. *Plant Soil* 182: 229-237.
80. Jones DL, AM Probowo and LV Kochian. 1996. Kinetics of malate transport and decomposition in acid soils and isolated bacterial populations: The effect of microorganisms on root exudation of malate under Al stress. *Plant Soil* 182: 239-247.
81. Lasat MM, AJM Baker and LV Kochian. 1996. Physiological characterization of root Zn^{2+} absorption and translocation to shoots in Zn hyperaccumulator and nonaccumulator species of *Thlaspi*. *Plant Physiol* 112: 1715-1722
82. Smart CJ, DF Garvin, JP Prince, WJ Lucas and LV Kochian. 1997. The molecular basis of potassium nutrition in plants. *Plant Soil* 187: 81-89.
83. Lasat MM, JM DiTomaso, JJ Hart and LV Kochian. 1997. Paraquat resistance in wall barley (*Hordeum glaucum* Steud.) Is correlated to increased vacuolar sequestration.

- Physiol Plantarum 99: 255-262.
84. Jones DL and LV Kochian. 1997. Aluminum interactions with plasma membrane lipids and enzyme metal binding sites and its potential role in Al cytotoxicity. FEBS Lett. 400: 51-57.
 85. Ebbs SD and LV Kochian. 1997. Toxicity of zinc and copper to Brassica species: Implications for phytoremediation. J Env Quality 26: 776-781.
 86. Cohen CK, Norvell WA and LV Kochian. 1997. Induction of the root-cell plasma membrane ferric reductase: An exclusive role for Fe and Cu. Plant Physiol 114: 1061-1069.
 87. Kochian LV and Jones DL. 1997. Aluminum toxicity and resistance in plants. In: Research Issues in Aluminum Toxicity, eds. R. Yokel and M.S. Golub, Taylor and Francis, Publishers, Washington, D.C., pp 69-89.
 88. Halperin, SJ, LV Kochian, and JP Lynch. 1997. Salinity stress inhibits calcium loading into the xylem of excised barley (*Hordeum vulgare*) roots. New Phytol 135: 419-427.
 89. Larsen, PB, LM Stenzler, C-Y Tai, J Degenhardt, SH Howell, and LV Kochian. 1997. Molecular and physiological analysis of Arabidopsis mutants exhibiting altered sensitivities to aluminum. Plant Soil 192: 3-7
 90. Pellet DM, LA Papernik, DA Jones, PR Darrah, DL Grunes and LV Kochian. 1997. Involvement of multiple aluminum exclusion mechanisms in aluminum resistance in wheat. Plant Soil 192: 63-68
 91. Ebbs SD, Lasat MM, Brady DJ, Cornish J and LV Kochian. 1997. Phytoextraction of Cd and Zn from a contaminated soil. J Env Qual 26: 1424-1430
 92. Larsen PB, LV Kochian and SH Howell. 1997. Aluminum inhibits both shoot development and root growth in *Als3*, an unusual aluminum-sensitive Arabidopsis mutant. Plant Physiol 114: 1207-1214
 93. Papernik LA and LV Kochian. 1997. Possible involvement of Al-induced electrical signals in aluminum tolerance in wheat. Plant Physiol 115: 657-667
 94. Lasat MM, WA Norvell and LV Kochian. 1997. Potential for phytoextraction of ¹³⁷Cs from a contaminated soil. Plant Soil 195: 99-106
 95. Jones DL, LV Kochian and S Gilroy. 1998. Aluminum induces a decrease in cytosolic [Ca²⁺] in BY-2 tobacco cell cultures. Plant Physiol 116: 81-89.
 96. Lasat MM, M Fuhrman, SD Ebbs, J Cornish and LV Kochian. 1998. Phytoremediation of a radiocesium-contaminated soil. Evaluation of ¹³⁷Cs bioaccumulation in the shoots of

- three plant species. *J Env Qual* 27: 165-169.
97. Ebbs S, Lasat M and L Kochian. 1998. Phytoremediation of radionuclide-contaminated soils: Field, greenhouse and laboratory studies. In: *Phytoremediation*. C.A. Thibeault and LM Savage, eds., IBC Library Series, Southborough, MA. pp. 213-235
 98. Cohen CK , TC Fox, DF Garvin and LV Kochian. 1998. The role of iron deficiency stress reponses in stimulating heavy metal transport in plants. *Plant Physiol* 116: 1063-1072.
 99. Pineros MA, JE Shaff and LV Kochian. 1998. Development, characterization and application of a cadmium-selective microelectrode for the measurement of cadmium fluxes in roots of *Thlaspi* species and wheat. *Plant Physiol* 116: 1393-1401.
 100. Ebbs SD and LV Kochian. 1998. Phytoextraction of zinc by oat (*Avena sativa*), barley (*Hordeum vulgare*) and indian mustard (*Brassica juncea*). *Environ Sci Tech* 32: 802-806.
 101. Larsen, PB, J Degenhardt, C-Y Tai, L Stenzler, SH Howell and LV Kochian. 1998. Aluminum-resistant Arabidopsis mutants that exhibit altered patterns of Al accumulation and organic acid release from roots. *Plant Physiol* 117: 9-18.
 102. Degenhardt J, Larsen PB, Howell SE and LV Kochian. 1998. Aluminum resistance in the Arabidopsis mutant *alr-104* is caused by an aluminum-induced increase in rhizosphere pH. *Plant Physiol* 117: 19-27.
 103. Hart JJ, Welch RM, Norvell WA, Sullivan LA and LV Kochian. 1998. Characterization of cadmium binding, uptake and translocation in intact seedlings of bread and durum wheat cultivars. *Plant Physiol* 116: 1413-1420.
 104. Ebbs SD, DJ Brady and LV Kochian. 1998. Role of uranium speciation in the uptake and translocation of uranium by plants. *J Exp Botany* 49: 1183-1190.
 105. Jones DL, S Gilroy, PB Larsen, SH Howell and LV Kochian. 1998. Effect of aluminum, oxidative, anaerobic and mechanical stress on cytoplasmic Ca²⁺ homeostasis in root hairs of *Arabidopsis thaliana*. *Planta* 206: 378-387.
 106. Lasat MM and LV Kochian. 1998. Physiological basis for Zn²⁺ hyperaccumulation in *Thlaspi caerulescens*. In *Radical Biology: Advances and Perspectives on the Function of Plant Roots*, HE Flores, JP Lynch, D Eissenstat, eds. American Society of Plant Physiologists, pp. 139-149.
 107. Ebbs SD, MM Lasat, LV Kochian, J Cornish, G Huddleston and M Fuhrmann. 1998. Phytoremediation of radionuclide contaminated soils - field, greenhouse and laboratory studies. In: *Phytoremediation*, IBC Library Series, Southborough, MA. Pp. 213-235
 108. Ebbs SD, WA Norvell and LV Kochian. 1998. Effect of acidification and chelating agents on the solubilization of uranium from contaminated soil. *J Envir Qual* 27: 1486-

1494

109. Lasat MM, AJM Baker and LV Kochian. 1998. Altered zinc compartmentation in the root symplasm and stimulated Zn^{2+} absorption in to the leaf as mechanisms involved in zinc hyperaccumulation in *Thlaspi caerulescens*. *Plant Physiol* 118: 875-883
110. Pineros MA, JE Shaff, LV Kochian and E Bakker. 1998. Selectivity of liquid membrane cadmium microelectrodes based on the ionophore N, N, N', N'-tetrabutyl-3,6-dioxaoctanedithioamide. *Electroanalysis* 10: 937-941.
111. Hart JJ, Norvell WA, Welch RM, Sullivan LA and Kochian LV. 1998. Characterization of zinc uptake, binding, and translocation in intact seedlings of bread and durum wheat cultivars. *Plant Physiology* 118: 219-226.
112. Lasat MM and LV Kochian. 1999. Physiology of Zn hyperaccumulation in *Thlaspi caerulescens*. In *Phytoremediation*, N Terry and GS Banuelos, eds., Ann Arbor Press, Chelsea, MI.
113. Kochian LV. 1999. Physiological mechanisms of aluminum tolerance in crop plants. In: (R. Schaffert, ed.) *Proceedings of a workshop to develop a strategy for collaborative research and dissemination of technology in sustainable crop production in acid savannahs and other problem soils of the world*. Purdue University Press, Indiana. pp. 69-72.
114. Kochian LV and DF Garvin. 1999. Agricultural approaches to improving phytonutrient content in plants: An overview. *Nut Reviews* 57: 13-18.
115. Welch, R.M., Hart, J.J., Norvell, W.A., Sullivan, L.A., Kochian, L.V. 1999. Effects of nutrient solution zinc activity on net uptake, translocation, and root export of cadmium and zinc by separated sections of intact durum wheat (*Triticum turgidum* L. var. durum) seedling roots. *Plant Soil* 208: 243-250.
116. Murphy AS, Eisinger WR, Shaff JE, Kochian LV, and L Taiz. 1999. Early copper-induced leakage of K^+ from *Arabidopsis* seedlings is mediated by ion channels and coupled to citrate efflux. *Plant Physiol* 121: 1375-1382.
117. Lasat MM, NS Pence, DF Garvin, SD Ebbs and LV Kochian. 2000. Molecular physiology of zinc transport in the Zn hyperaccumulator *Thlaspi caerulescens*. *J Exp Bot* 51: 71-79
118. Ebbs S, L Kochian, Lasat M, N Pence and T Jiang. 2000. An integrated investigation of the phytoremediation of heavy metal and radionuclide contaminated soils: From the laboratory to the field. In *Remediation of Hazardous Wastes and Contaminated Soils*, 2cd Edition, DL Wise, DJ Trantolo, HI Inyang and EJ Cichon, eds. Marcel Dekker, Inc., New York, NY, pp. 745-769

119. Pence NS, Larsen PB, Ebbs SD, Lasat MM, Letham DLD, Garvin DF, Eide D and LV Kochian, 2000. The molecular basis for heavy metal hyperaccumulation in *Thlaspi caerulescens*. Proc Natl Acad Sci USA 97: 4956-4960
120. Cakmak I, Welch RM, J Hart, Norvell WA, Ozturk L, and LV Kochian. 2000. Uptake and re-translocation of leaf-applied cadmium (^{109}Cd) in diploid, tetraploid and hexaploid wheats. J Exp Bot 51: 221-226
121. Kochian LV. 2000. Can we gain insights into mechanisms of P efficiency by studying aluminum tolerance in crop plants? Proceedings of a Workshop on Improving Phosphorus Acquisition Efficiency in Marginal Soils". EMBRAPA, Sete Lagoas, Brazil
122. Tang Y, Sorrells ME, Kochian LV and DF Garvin. 2000. Identification of RFLP markers linked to barley aluminum tolerance gene *Alp*. Crop Sci 40: 778-782
123. Cakmak, I., Welch, R.M., Erenoglu, B., Romheld, V., Norvell, W.A., Kochian, L.V. 2000. Influence of varied zinc supply on re-translocation of cadmium (^{109}Cd) and rubidium (^{86}RB) applied on mature leaf of durum wheat seedlings. Plant Soil 219: 279-284.
124. Kochian LV. 2000. Chapter 23: Molecular physiology of mineral nutrient acquisition, transport and utilization. In: Biochemistry and Molecular Biology of Plants. Bob B. Buchanan, Wilhelm Gruissem and Russell L. Jones, eds. American Society of Plant Physiologists, pp. 1204-1249.
125. Pineros MA, Kochian LV. 2001. A patch clamp study on the physiology of aluminum toxicity and tolerance in *Zea mays*: Identification and characterization of Al^{3+} -induced anion channels. Plant Physiol 124: 1-14.
126. Hacisalihoglu G. Hart JJ, Kochian LV. 2001. High and low affinity zinc transport systems and their possible role in zinc efficiency in bread wheat (*Triticum aestivum* L.). Plant Physiol 125: 1-8.
127. Papernik LA, Bethea AS, Singleton TE, Magalhaes JV, Garvin DF and Kochian LV. 2001. Physiological basis of reduced Al tolerance in ditelosomic lines of Chinese Spring wheat. Planta 212: 829-834
128. Wang, Y.-H., Garvin D.F., and Kochian L.V. 2001. Nitrate-induced genes in tomato roots: Array analysis reveals novel genes that may play a role in nitrogen nutrition. Plant Physiology 127: 345-359.
129. Lasat MM, Pence NS, Letham DLD, and Kochian LV. 2001. Zinc phytoextraction in *Thlaspi caerulescens*. Int J Phytoremediation 3: 129-144.
130. Pineros MA, and Kochian LV. 2001. H^+ currents around plants. In: Handbook of Plant Growth. PH as a Master Variable in Plant Growth. Marcel Dekker, Inc., New York.

Chapter 12, pp. 299-322.

131. Ebbs SD, Lau I, Ahner B, and LV Kochian. 2002. Phytochelatin synthesis is not responsible for Cd tolerance in the Zn/Cd hyperaccumulator, *Thlaspi caerulescens*. *Planta* 214: 635-640.
132. Hart JJ, Welch RM, Norvell WA, and Kochian LV. 2002. Measurement of thiol-containing amino acids and phytochelatins via capillary electrophoresis with laser-induced fluorescence detection. *Electrophoresis* 23: 81-87.
133. Pineros MA, Magalhaes JV, Alves VM, and Kochian LV. 2002. A physiological and biophysical examination of aluminum tolerance in maize suggests the existence of multiple tolerance mechanisms. *Plant Physiol* 129: 1194-120.
133. Tang Y, BF Carver, ME Sorrells, LV Kochian and DF Garvin. 2002. Physiological genetics of mechanisms associated with aluminum tolerance in the wheat cultivar Atlas 66. *Crop Sci* 42: 1541-1546.
135. Wang, Y-H., Garvin D.F., and Kochian L.V. 2002. Rapid induction of regulatory and transporter genes in response to phosphorous, potassium and iron deficiencies in tomato roots. Evidence for cross talk and root/rhizosphere mediated signals. *Plant Physiol* 130: 1361-1370.
136. Kochian LV, Pence NS, Letham DLD, Pineros MA, Magalhaes JV, Hoekenga OA, and Garvin DF. 2002. Mechanisms of toxic metal resistance in plants: Aluminum and heavy metals. *Plant and Soil* 247: 109-119.
137. Fuhrmann M, Lasat ML, Ebbs SD, Kochian LV, and J Cornish. 2002. Uptake of cesium-137 and strontium-90 from contaminated soil by three plant species: Application to phytoremediation. *J Envir Qual* 31: 904-909.
138. Garg AK, Kim J-K, Owens TG, Ranwala AP, Choi YD, Kochian LV, and RJ Wu. 2002. Trehalose accumulation in rice plants confers high tolerance levels to different abiotic stresses. *Proc Natl Acad Sci USA* 99: 15898- 15903.
139. Hart JJ, Welch RM, Norvell WA, Kochian LV. 2002. Transport interactions between cadmium and zinc in roots of bread and durum wheat seedlings. *Physiol Plant* 116: 73-78.
140. Hacisalihoglu G, JJ Hart, Y-H Wang, I Cakmak, and LV Kochian. 2003. Zinc efficiency is correlated with enhanced expression and activity of Zn-requiring enzymes in wheat. *Plant Physiology* 131: 595-602.
141. Pineros, MA and LV Kochian. 2003. Differences in whole cell and single channel ion currents across the plasma membrane of mesophyll cells from two closely related *Thlaspi* species. *Plant Physiology* 131: 583-594.

142. Wang Y-H, Kochian LV, Doyle JF, and Garvin DF. 2003. Differential regulation of two tomato nonsymbiotic hemoglobin genes in response to diverse changes in nutrient status. *Plant Cell Environ* 26: 673-680.
143. Levent O, Cakmak I, and LV Kochian. 2003. Shoot biomass and zinc/cadmium uptake for hyperaccumulator and non-accumulator *Thlaspi* species in response to growth on a zinc-deficient calcareous soil. *Plant Science* 164: 1065-1071.
144. Hoekenga OA, Vision TJ, Shaff JE, Monforte AJ, Lee GP, Howell SH, and LV Kochian. 2003. Identification and characterization of Al tolerance loci in *Arabidopsis thaliana* (Landsberg x Columbia) by quantitative trait locus mapping: A physiologically simple but genetically complex trait. *Plant Physiology* 132: 936-948.
145. Hacisalihoglu G, and LV Kochian. 2003. How do some plants tolerate low levels of soil zinc? Mechanisms of zinc efficiency in crop plants. *New Phytologist* 159: 341-350.
146. Raman H, Karakousis A, Moroni JS, Raman R, Read BJ, Garvin DF, Kochian LV, and Sorrells ME. 2003. Development and allele diversity of microsatellite markers linked to the barley aluminum tolerance gene ALP. *Australian Journal of Agricultural Research* 54: 1315-1321.
147. Fuhrmann M, Lasat M, Ebbs S, Cornish J, L Kochian. 2003. Uptake and release of cesium-137 by five plant species as influenced by soil amendments in field experiments. *J Environ Qual* 32: 2272-2279.
148. Hacisalihoglu G, Ozturk L, Cakmak I, Welch RM, and Kochian LV. 2003. Genotypic variation in common bean in response to zinc deficiency in calcareous soil. *Plant Soil* 259: 71-83.
149. Kochian LV, Hoekenga OA, Pineros MA. 2004. How do crop plants tolerate acid soils? Mechanisms of aluminum tolerance and phosphorous efficiency. *Ann. Rev. Plant Biol.* 55: 459-493
150. Hacisalihoglu G, Hart JJ, Vallejos E and Kochian LV. 2004. The role of shoot-localized processes in the mechanism of Zn efficiency in common bean. *Planta* 218: 704-711
151. Cohen CK, Garvin DF, and Kochian LV. 2004. Kinetic properties of a micronutrient transporter from *Pisum sativum* indicate a primary function in Fe uptake from the soil. *Planta* 218: 784-792.
152. Magalhaes JV, Garvin DF, Sorrells ME, Klein PE, Schaffert RE, Wang Y-H, Li L, and LV Kochian. 2004. Comparative mapping of a major aluminum tolerance gene in sorghum and other species in the Poaceae. *Genetics* 167: 1905-1914.
153. Huang JH, Poynton CY, Kochian LV, and Elless MP. 2004. Phytofiltration of arsenic from drinking water using an arsenic-hyperaccumulating fern. *J Env Qual* 38: 3412-3417.

154. Poynton CY, Huang JW, Blaylock MJ, Kochian LV, and MP Elless. 2004. Mechanisms of arsenic hyperaccumulation in *Pteris* species: Root As influx and translocation. *Planta* 219: 1080-1088.
155. Papoyan A, and Kochian LV. 2004. Identification of *Thlaspi caerulescens* genes that may be involved in heavy metal hyperaccumulation and tolerance: Characterization of a novel heavy metal transporting ATPase. *Plant Physiol* 136: 3814-3823.
156. Pineros MA, Shaff JE, Manslank HS, Alves VMC, and LV Kochian. 2005. Aluminum resistance in maize can not be solely explained by root organic acid exudation: A comparative physiological study. *Plant Physiol* 137: 231-241.
157. Letham DLD, Pence NS, Lasat MM, and LV Kochian. 2005. Molecular and physiological investigations of *Thlaspi caerulescens*, a Zn/Cd hyperaccumulator. In: *Roots and Soil Management: Interactions between Roots and the Soil*. RF Zobel and SF Wright, eds. Agronomy Society of America Monographs; pp. 95-106.
158. Hart JJ, Welch RM, Norvell WA, Clarke JM, and LV Kochian. 2005. Zinc effects on cadmium accumulation and partitioning in near isogenic lines of durum wheat that differ in grain cadmium concentration. *New Phytologist* 167: 391-401
159. Kochian LV, Piñeros MA, Hoekenga OA. 2005. The physiology, genetics and molecular biology of plant aluminum resistance and toxicity. *Plant and Soil* 274: 175-195.
160. Raman H, K Zhang, M Cakir, R Appels, JS Moroni, LG Maron, LV Kochian, R Raman, I Muhammad, F-D Brockman, DF Garvin, I Waters, P Martin, T Sasaki, Y Yamamoto, H Matsumoto, DM Hebb, E Delhaize, and PR Ryan. 2005. Molecular characterization and mapping of *ALMT1*, the aluminium-tolerance gene of bread wheat (*Triticum aestivum* L.). *Genome* 48: 781-791.
161. Kochian L, Hoekenga OA, Magalhaes J, Pineros M, Alves V, Maron L, Mason P, Guimares C, and Schaffert R. 2005. Integrating genomics, molecular genetic and physiological approaches to identify plant aluminum tolerance genes and their associated physiological mechanisms. In: *Plant Nutrition for Food Security, Human Health, and Environmental Protection*. CJ Li, FS Zhang et al., eds., Tsinghua University Press, Beijing, China. Pp. 18-20.
162. Liao H, Wan H, Shaff JE, Wang X, Yan X, and Kochian LV. 2006. Phosphorus and aluminum interactions in soybean in relation to Al tolerance: Exudation of specific organic acids from different regions of the intact root system. *Plant Physiol* 141: 674-684.
163. Hoekenga OA, Maron LG, Pineros MA, Cancado GMA, Shaff JE, Kobayashi Y, Ryan PR, Dong B, Delhaize E, Sasaki T, Matsumoto H, Koyama H, and LV Kochian. 2006. *AtALMT1* (At1g08430) is a novel, essential factor for aluminum tolerance in *Arabidopsis thaliana* and encodes an aluminum-activated malate transporter. *Proc Natl Acad Sci USA*

- 103: 9738-9743.
164. Jones DL, Blancaflor EB, Kochian LV, and Gilroy S. 2006. Spatial coordination of aluminium uptake, production of reactive oxygen species, callose production and wall rigidification in maize roots. *Plant, Cell and Envir* 1309-1318.
 165. Caniato FF, Guimarães CT, Schaffert RE, Alves VMC, Kochian LV, Borém A, Klein PE, Magalhaes JV. 2006. Genetic diversity for aluminum tolerance in sorghum. *Theor Applied Genetics* 114: 863-867.
 166. Hart JJ, Welch RM, Norvell, WA, and Kochian LV. 2006. Characterization of cadmium uptake, translocation and storage in near-isogenic lines of durum wheat that differ in grain cadmium concentration. *New Phytol* 172: 261-271
 167. Kupper H, Seib LO, Sivaguru M, Hoekenga OA, and LV Kochian. 2007. A novel method for quantitative *in situ* hybridization in plants reveals regulation of a zinc transporter in the Cd/Zn hyperaccumulator *Thlaspi caerulescens* (Ganges). *Plant Journal* 50: 159-175.
 168. Lyi SM, Zhou X., Kochian LV, Li L. 2007. Biochemical and molecular characterization of the homocysteine S-methyltransferase from broccoli (*Brassica oleracea* var. *italica*). *Phytochemistry* 68: 1112-1119.
 169. Papoyan A, Pineros MA, Kochian LV. 2007. Plant Cd²⁺ and Zn²⁺ status effects on root and shoot heavy metal accumulation in *Thlaspi caerulescens*. *New Phytol* 175: 51-58.
 170. Magalhaes JM, Liu J, Guimares CT, Lana UGP, Alves VM, Wang Y-H, Schaffert RE, Hoekenga OA, Shaff JE, Pineros MA, Klein PE, and LV Kochian. 2007. A gene in the multidrug and toxic compound extrusion (MATE) family confers aluminum tolerance in sorghum.. *Nature Genetics* 39: 1156-1161.
 171. Kobayasi Y, Hoekenga OA, Ito H, Nakashima M, Saito S, Shaff JE, Maron LG, Piñeros MA, Kochian LV, Koyama H. 2007. Characterization of *AtALMT1* expression in aluminum inducible malate release and its role for rhizotoxic stress tolerance in *Arabidopsis thaliana*. *Plant Physiol* 145: 843-852.
 172. Parameswaran A, Leitenmaier B, Yang M, Welte W, Kroneck PMH, Papoyan A, Kochian LV, Küpper H. 2007. A native Zn/Cd transporting P1B ATPase from natural overexpression in a hyperaccumulator plant reveals post-translational processing. *Biochem Biophys Research Comm* 363: 51-56.
 173. Li, L., Lyi, S.M., Zhou, X., Kochian, L.V. 2007. Biochemical and molecular characterization of the homocysteine s-methyltransferase from broccoli (*brassica oleracea* var. *italica*). *Phytochemistry*. 68:1112-1119.
 174. Pineros MA, Cancado GMA, Maron LG, Lyi MS, Menossi M, Kochian LV. 2008. Not all ALMT1-type transporters mediate aluminum-activated organic acid responses: The

- case of *ZmALMT1*. *Plant Journal* 53: 352-367.
175. Maron LG, Kirst M, Mao C, Milner MJ, Menossi M and LV Kochian. 2008. Transcriptional profiling of aluminum toxicity and tolerance responses in maize roots. *New Phytol* 179: 116–128.
 176. Pineros MA, Cancado GMA, Kochian LV. 2008. Novel properties of the wheat aluminum tolerance organic acid transporter (TaALMT1) revealed by electrophysiological characterization in *Xenopus* oocytes: Functional and structural implications. *Plant Physiol* 147: 2131-2146.
 177. Klein MA, Sekimoto H, Milner MJ and LV Kochian. 2008. Investigation of heavy metal hyperaccumulation at the cellular level: development and characterization of *Thlaspi caerulescens* suspension cell lines. *Plant Physiol* 147: 2006-2016.
 178. Milner MJ, Kochian LV. 2008. Investigating heavy-metal hyperaccumulation using *Thlaspi caerulescens* as a model system. *Ann Bot* 102: 3-13
 179. Sooksanguan T, Yakubov B, Kozlovskyy VI, Barkume CM, Howe KJ, Thannhauser TW, Rutzke MA, Hart JJ, Kochian LV, Rea PA, and OK Vatamaniuk. 2009. *Drosophila* ABC Transporter, DmHMT-1, Confers Tolerance to Cadmium. DmHMT-1 and its yeast homolog, SpHMT-1, are not essential for vacuolar phytochelatin sequestration. *J. Biol Chem* 284: 354-362.
 180. Kochian LV, Hoekenga OA, Magalhaes JV, Pineros MA. 2009. Maize aluminum tolerance. In: *The Maize Handbook - Volume 1: The Biology of Maize* (Bennetsen J, and Hake, S,eds). Springer-Verlag, New York, NY, pp. 367-380.
 181. Liu J, Magalhaes JV, Shaff JE, Kochian LV. 2009. Aluminum-activated citrate and malate transporters from the MATE and ALMT families function independently to confer Arabidopsis aluminum tolerance. *Plant Journal* 57: 389-399.
 182. Ligaba A, Kochian LV, Pineros MA. 2009. Phosphorylation at S384 regulates the activity of the TaALMT1 malate transporter that underlies aluminum resistance in wheat. *Plant Journal* 60: 411-423.
 183. Wang Y-H, Mosebach CM, Kibbey AS, Ryhal MK, Jones AD, Kochian LV. 2009. Generation of Arabidopsis mutants by heterologous expression of a full length cDNA library from tomato fruits. *Plant Mol Biol Reporter* 27: 454-461.
 184. Kuepper H, and LV Kochian. 2009. Transcriptional regulation of metal transport genes and mineral nutrition during acclimation to cadmium and zinc in the Cd/Zn hyperaccumulator, *Thlaspi caerulescens* (*Ganges population*). *New Phytologist* 185: 114-129.

185. Liu JW, Magalhaes JV, Shaff JE, Kochian LV. 2009. Arabidopsis combines the function of aluminum-activated citrate and malate transporters from the MATE and ALMT families in aluminum tolerance. Proceedings of the 7th International Symposium on Plant-Soil Interactions at Low pH, Guangzhou, China, pp. 69-70.
186. Maron LG, Guimaraes CT, Mao C, LV. Kochian 2009. Transcriptional profiling of aluminum toxicity and tolerance responses in maize roots. . Proceedings of the 7th International Symposium on Plant-Soil Interactions at Low pH, Guangzhou, China, 138-139.
187. Kochian LV, Magalhaes JV, Liu J, Hoekenga OA, Pineros MA. 2009. Recent advances on the molecular basis of crop aluminum resistance. Proceedings of the 7th International Symposium on Plant-Soil Interactions at Low pH, Guangzhou, China, pp. 1-2.
188. Hoekenga OA, Buckler ES, Kirst M, Krill AM, Lyi SM, Magalhaes JV, Maron LG, Kochian LV. 2009. Joint linkage-association analysis of aluminium tolerance in maize. Proceedings of the 7th International Symposium on Plant-Soil Interactions at Low pH, Guangzhou, China, pp. 136-137.
189. Pineros MA, Kochian LV. 2009. Overview of the structure-function relations underlying the functionality of ALMT and MATE-type transporters involved in the organic acid release Al tolerance response. Proceedings of the 7th International Symposium on Plant-Soil Interactions at Low pH, Guangzhou, China, pp. 55-56.
190. Ligaba A, Pineros MA, Kochian LV. 2009. Modulation of TaALMT1 transport activity by protein phosphorylation. . Proceedings of the 7th International Symposium on Plant-Soil Interactions at Low pH, Guangzhou, China, pp. 73-74.
191. Shaff JE, Schultz BA, Craft EJ, Clark RT, Kochian LV. 2009. GEOCHEM-EZ: A chemical speciation program with greater power and flexibility. Proceedings of the 7th International Symposium on Plant-Soil Interactions at Low pH, Guangzhou, China, pp. 27-28.
192. Clark, Kochian LV. 2009. Investigating whole root systems: Advances in root quantification tools and techniques. Proceedings of the 7th International Symposium on Plant-Soil Interactions at Low pH, Guangzhou, China, pp. 143-144.
193. Guimaraes CT, Magalhaes JV, Jardim SN, Almeida RV, Maron L, Parentoni SN, Alves VMC, Lana UGP, Gama EEG, Hoekenga O, Paiva E, Kochian LV. 2009. QTL and selection mapping for Al tolerance in tropical maize. Proceedings of the 7th International Symposium on Plant-Soil Interactions at Low pH, Guangzhou, China, pp. 147-148.

194. Koyama H, Iuchi S, Hoekenga O, Kobayashi Y, Sawaki Y, Kobayashi Y, Kochian LV, Kobayashi W. 2009. Signal transduction pathway of the Al responsive malate release in Arabidopsis – Involvement of reversible protein phosphorylation and STOP1 transcription factor. Proceedings of the 7th International Symposium on Plant-Soil Interactions at Low pH, Guangzhou, China, pp. 67-68.
195. Zhou X, Yuan Y, Yang Y, Rutzke M, Thannhauser TW, Kochian LV, Li L. 2009. Involvement of a Broccoli COQ5 Methyltransferase in the Production of Volatile Selenium Compounds. *Plant Physiol* 151: 528-540.
196. Kochian LV, Magalhaes JV, Liu J, Schaffert RE, Guimarães CT, Alves VMC, Klein PE. The sorghum aluminum tolerance gene, SbMATE. 2009. US Patent # US 7,582, 809 B2. Awarded 9-1-09.
197. Maron LG, Piñeros MA, Guimarães CT, Magalhaes JV, Pleiman JF, Mao C, Shaff JE, Belicuas SNJ, Kochian LV. 2010. Two functionally distinct members of the MATE (multidrug and toxic compound extrusion) family of transporters potentially underlie two major Al tolerance QTL in maize. *Plant Journal* 61: 728-740.
198. Shaff JE, Schultz BE, Craft EJ, Clark RT, Kochian LV. 2010. GEOCHEM-EZ: A Chemical Speciation Program with Greater Power and Flexibility. *Plant Soil* 330:207–214.
199. Krill AM, Kirst M, Kochian LV, Buckler ES, Hoekenga OA. 2010. Association and linkage analysis of aluminum tolerance genes in maize. *PLoS One* 5: 1-11.
200. Famoso AN, Clark RT, Shaff JE, Craft E, McCouch SR, Kochian LV. 2010. Development of a novel aluminum tolerance phenotyping platform used for comparisons of cereal aluminum tolerance and investigations into rice aluminum tolerance mechanisms. *Plant Physiol.*153: 1678–1691.
201. Lung'aho MG, Mwaniki AM, Szalma SJ, Cheng Z, Hart JJ, Rutzke M, Kochian LV, Glahn RP, Hoekenga OA. 2011. Genetic and physiological analysis of iron biofortification in maize kernels. *PLoS One* 5(4): e20429. doi:10.1371/journal.pone.0020429.
202. Clark RT, MacCurdy RB, Jung JJ, Shaff JE, McCouch SR, Aneshansley DJ, Kochian LV. 2011. 3-Dimensional root phenotyping with a novel imaging and software platform. *Plant Physiol* 156: 455-465.
203. Milner MJ, Ueno D, Yamaji N, Yokosho K, Zambrano MC, Kaskie M, Ebbs SD, Kochian LV, Ma JF. 2011. Elevated expression of *TcHMA3* plays a key role in the extreme Cd tolerance exhibited by a Cd-hyperaccumulating ecotype of *Thlaspi caerulescens*. *Plant Journal* 66: 852-862.

204. Caniato FF, Guimarães CT, Hamblin M, Billot C, Rami J-F, Maciel BH, Kochian LV, Liu J, Garcia AAF, Hash CT, Ramu P, Mitchell S, Kresovich S, Oliveira AC, Avelar G, Borém A, Glaszmann J-C, Schaffert RE, Magalhaes JV. 2011. The relationship between population structure and aluminum tolerance in cultivated sorghum. *PLoS One* 6(6): e20830.

Invited Talks and Seminars:

Seminar speaker on "The kinetics, regulation, and localization of potassium uptake in corn roots. Botany Department, University of California, Davis, 1982.

Invited speaker on "The theory, construction, characterization, and application of ion-selective microelectrodes to plants", NATO Symposium on Advanced Instrumentation in Agriculture, Pisa, Italy, 1984.

Invited speaker on "The physiological significance of the linear component for potassium influx in corn roots", Sixth International Workshop on Plant Membrane Transport, Prague, Czechoslovakia, 1983.

Seminar speaker on "The involvement of plasmalemma-associated redox systems with ion transport in corn roots", Carnegie Institute, Stanford University, 1984.

Seminar speaker on "Studies on the kinetics, regulation, and spatial localization of ion fluxes in *Zea mays* roots", U.S. Plant, Soil and Nutrition Laboratory, USDA-ARS, Ithaca, NY 1985.

Seminar speaker on "Biophysical and physiological investigations of root ion transport processes", Agronomy Department, Cornell University, 1986.

Invited speaker on "Root ion transport processes: A historical perspective", U.S.-Spain Symposium on Electron Transfer Constituents of the Eukaryotic Plasma Membrane. Madrid, Spain, 1986.

Invited speaker on "Ion transport in corn roots: Localized stoichiometries for H^+ , K^+ , and Cl^- ", Seventh International Workshop on Plant Membrane Transport, University of Sydney, Australia, 1986.

Seminar speaker on "The use of microelectrodes to investigate root ion transport phenomena", Plant Biology, Cornell University, 1986.

Seminar speaker on "An investigation of the coupling of K^+ and H^+ fluxes in corn roots", Botany

Department, University of Massachusetts, Amherst, 1987.

Seminar speaker on "Transport mutants: A novel approach to the investigation of iron transport in plants", Agronomy Department, Cornell University, 1987.

Seminar speaker on "Is K^+ uptake coupled to the H^+ -ATPase in plant cells?", Botany Department, Rutgers University, 1988.

Invited speaker on "Transport mutants for the study of root iron uptake", Eighth International Workshop on Plant Membrane Transport, Venice, Italy, 1989.

Seminar speaker on "Investigating genotypic differences in plant mineral nutrient acquisition in relation to environmental stresses", Department of Land, Air, and Water Resources, University of California, Davis, 1989.

Invited speaker on "Investigating the relationship between aluminum toxicity, root growth, and root-generated ion currents", Second International Symposium on Plant-Soil Interactions at Low pH, Beckley, West Virginia, 1990.

Invited speaker on "Use of microelectrode techniques for the study of plant ion transport processes", International Workshop on Root-Soil Interactions, Cornell University, Ithaca, NY, 1990.

Seminar speaker on "Investigating iron uptake by plant roots using transport mutants", Botany Department, University of Alberta, Edmonton, Canada, 1990.

Invited speaker on "Microelectrode-based investigations into the relationship between Al toxicity and root-cell membrane transport processes", 10th Annual Current Topics in Biochemistry and Plant Physiology Symposium, University of Missouri-Columbia, Columbia, MO, 1991.

Invited speaker on "Investigating the mechanisms and regulation of iron absorption in higher plants using transport mutants", VIth International Symposium on Iron Nutrition and Interactions in Plants, Utah State University, Logan, Utah, 1991.

Invited speaker on "Biophysical and physiological studies on the regulation of Fe absorption in a single-gene mutant of *Pisum sativum*", Fourth International Symposium on the Genetic Aspects of Plant Mineral Nutrition, Canberra, Australia, 1991.

Seminar speaker on "Elucidating the mechanisms of aluminum toxicity in higher plants: The role of electric fields, H^+ transport and calcium homeostasis". Botany Department, University of British Columbia, Vancouver, B.C. April, 1992.

Invited speaker on "Biophysical and genetic studies on the role of root cell ion transport processes in aluminum toxicity and tolerance", Ninth International Workshop on Plant Membrane Biology, Monterey, CA, 1992.

Seminar speaker on "The molecular biology, biophysics and physiology of K^+ transport in higher plants", Section of Plant Physiology, Penn State University, April 6, 1993.

Seminar speaker on "Role of root-cell calcium transport in aluminum toxicity", Department of Horticulture, Michigan State University, April 29, 1993.

Invited speaker on "The role of root cell ion transport process in mechanisms of aluminum toxicity and tolerance", 3rd International Symposium on Plant-Soil Interactions at Low pH, Brisbane, Australia, September 12-16, 1993.

Invited speaker on "Towards an understanding of the molecular basis of plant K^+ transport: Characterization of cloned K^+ transport cDNAs", 12th International Plant Nutrition Colloquium, Perth, Australia, September 21-26, 1993.

Invited speaker on "Absorption of zinc from solution", International Symposium on Zinc in Soils and Plants, Perth, Australia, September 27-28, 1993.

Seminar speaker on "Potassium transport in plants: A molecular and biophysical analysis of plant mineral nutrition", Department of Soil, Crop and Atmospheric Sciences, Cornell University, November 23, 1993.

Seminar speaker on " K^+ transport in plants: A molecular and biophysical analysis of plant mineral nutrition", Department of Horticulture, Purdue University, December 7, 1993.

Invited speaker on "The role of ion transport processes in root hair elongation and function", 9th Annual Penn State Symposium in Plant Physiology, May 20, 1994.

Invited speaker on "Potassium transport in higher plants: A molecular, biophysical and developmental analysis", 5th International Symposium on the Genetic Aspects and Molecular Biology of Mineral Nutrition in Higher Plants, Davis CA, July 18, 1994.

Invited speaker on "Transport and translocation processes involved in the hyperaccumulation of heavy metals by plants", DOE-Sponsored Workshop on Phytoremediation Research Needs, Santa Rosa, CA, July 24-26, 1994.

Seminar speaker on "The role of root exudates and ion transport processes in root responses to environmental stress", Department of Plant Pathology, Cornell University, September 21, 1994.

Seminar speaker on "Basic and applied aspects of phytoremediation of polluted soils", Graduate Field of Environmental Toxicology, Cornell University, February 10, 1995.

Invited speaker on "Phytoremediation of metal-polluted soils: From the laboratory to the field", 14th Annual Symposium: Current Topics in Plant Biochemistry, Physiology and Molecular Biology, University of Missouri, April 20, 1995.

Invited speaker on "Potassium transport in higher plants: Molecular, biophysical and

physiological analysis”, 14th Long Ashton Symposium, IACR-Long Ashton Research Station, September 14, 1995.

Seminar speaker on “The cellular basis for aluminum toxicity and resistance in plants: Developing crops for cultivation on acid soils”, Botany Department, University of Toronto, October 27, 1995.

Seminar speaker on “Phytoremediation of metal-polluted soils: From the laboratory to the field - Part II”, Department of fruit and Vegetable Crops, Cornell University, February 14, 1996.

Seminar speaker on the “Cellular and molecular biology of aluminum toxicity and resistance in plants”, The Interdisciplinary Plant Group, University of Missouri, March 7, 1996.

Invited speaker on “The physiology, genetics and molecular biology of aluminum resistance in higher plants”, 4th International Symposium on Plant-Soil Interactions at Low pH, Belo Horizonte, Brazil, March 20, 1996.

Seminar speaker on “Potassium transport in higher plants: Molecular, Biophysical and physiological analysis”, Biology and Physics Departments, California State University at Fresno, March 26, 1996.

Invited speaker on “Mechanisms of heavy metal transport across plant cell membranes”. International Symposium on Phytoremediation, Washington, D.C., May 8-10, 1996.

Seminar speaker on “Molecular and Physiological Investigations of Aluminum Toxicity and Tolerance in Plants,” Plant Science Department, University of Arizona, Tucson, AZ. October 1996.

Invited speaker on “Radical Biology Meets Heavy metal: Phytoremediation of Contaminated Soils” 11th Annual Penn State Symposium in Plant Physiology - Radical Biology: An International Symposium in Root Biology, Penn State University, May, 1997.

Invited speaker on “Phytoremediation of Radionuclide Contaminated Soils - Field, Greenhouse and Laboratory Studies”, IBC’s Second International Conference on Phytoremediation, Seattle, WA, June, 1997.

Invited speaker on “Mechanisms of Heavy Metal Transport in Hyperaccumulating Plant Species”, Fourth International Conference on the Biogeochemistry of Trace Elements, Berkeley, CA, June, 1997.

Invited speaker on “Mechanisms and Regulation of Plant Membrane Transport”, International Course on Plant Biochemistry - Biochemistry 97, Sponsored by USDA, DOE and ASPP, Washington State University, Pullman, WA, July, 1997.

Seminar speaker on "Physiological and molecular investigations of heavy metal hyperaccumulation in plants", Interdisciplinary Plant Biology Group (multi-departmental),

University of Missouri, Columbia, MO, Dec 1997.

Course lecturer on “Aluminum tolerance and toxicity in plants” (2 lectures), Plant Mineral Nutrition course (graduate course), Agronomy Dept, University of Missouri, Columbia, MO, Dec 1997.

Invited speaker on “Agricultural strategies to improve phytonutrient content” at an international symposium entitled “Food, phytonutrients and health” held in College Park, MD, March 1998.

Invited speaker on “State of the science on the physiological nature of Al tolerance for crops grown on acid soils” for an international workshop on Strategies for Developing Acid Tolerant Crops sponsored by Embrapa (Brazil) and Purdue University, May, 1998.

Seminar speaker on “The molecular physiology of heavy metal transport in a unique hyperaccumulating plant species”, Section of Plant Biology, University of California, Davis, June 1998.

Seminar speaker on “The molecular physiology of heavy metal transport in a unique hyperaccumulating plant species”, Horticulture Department, Purdue University, September 1998.

Invited speaker on “The molecular physiology of micronutrient and heavy metal transport from the apoplast” for an international symposium entitled “The Apoplast of Higher Plants” held in Wurzburg, Germany, Nov. 1998.

Invited speaker on “A molecular and physiological analysis of heavy metal tolerance and transport in a unique hyperaccumulating plant species” for an international symposium entitled “Molecular Physiology II: Engineering Crops for Hostile Environments” held in Rothamsted, England, Dec 1998.

Seminar speaker on “The molecular physiology of heavy metal transport in a unique hyperaccumulating plant species”, Crop Science Department, Texas A&M University, February, 1999

Invited speaker on “Aluminum tolerance mechanisms in grain crops and Arabidopsis” for an international Workshop entitled Genetic Analysis and Engineering of Aluminum Tolerance in Plants, Campinas, Brazil, May 17-18, 1999.

Invited keynote speaker (“The role of rhizosphere processes in the bioavailability of trace elements to Plants) and symposium speaker at two symposia (“A molecular physiological analysis of heavy metal transport in a hyperaccumulating plant species” for the Phytoremediation Symposium; and “A physiological and genetic investigation of the role of root exudates in aluminum tolerance” for the Rhizosphere symposium) at the 5th International Conference on the Biogeochemistry of Trace Elements, Vienna, Austria, July 11-15, 1999.

Invited speaker on “Plant-based mechanisms of aluminum tolerance and P efficiency on acid soils” at an International Workshop on Improving Phosphorous Acquisition Efficiency in

Marginal Soils in Sete Lagoas, Brazil, Oct 17-22, 1999.

Invited speaker on “Molecular Physiology of heavy metal transport in *Thlaspi caerulescens*” at the 3rd Mexico-US Symposium on Plant Biochemistry and Molecular Biology, Merida, Yucatan, Mexico, Oct 30-Nov 2, 1999

Seminar speaker on “The molecular physiology of heavy metal transport in a unique hyperaccumulating plant species”, Biology Department, University of South Carolina, March 13, 2000.

Invited keynote speaker on “A molecular and physiological analysis of heavy metal transport in the hyperaccumulating plant species, *Thlaspi caerulescens*” at a symposium entitled “Phytoremediation 2000 : State of the art “ held in Crete, Greece on April 4-9.

Seminar speaker on “Molecular physiology of heavy metal hyperaccumulation and tolerance in plants” Department of Plant Sciences, Cambridge University, Cambridge U.K., Sept 5, 2000.

Invited keynote speaker on “Improving the mineral micronutrient content of staple food crops” at the European Conference on Nutritional Enhancement of Plant Foods held at the John Innes Institute, Norwich, U.K. on September 6-9, 2000.

Invited speaker on “Use of an in vitro digestion/caco-2 cell culture model to measure food iron availability” at the European Conference on Nutritional Enhancement of Plant Foods held at the John Innes Institute, Norwich, U.K. on September 6-9, 2000.

Invited keynote speaker on “Investigating the physiological and genetic complexity of aluminum tolerance in crop plants” at the International Symposium on Impact of Potential Tolerance of P Plants on Increased Productivity Under Aluminum Stress, Kurashiki, Japan, September 15-16, 2000.

Invited keynote speaker on “Investigating the complexity of aluminum tolerance mechanisms in cereal crops” at the 5th International Symposium on Plant-Soil Interactions at Low pH held in Alpine Heath, South Africa, on March 12-16, 2001.

Invited speaker on “Mechanisms of aluminum tolerance in cereals and possible interactions with phosphate acquisition efficiency” at a Rockefeller Foundation workshop on Improving Phosphorous Acquisition Efficiency in Marginal Soils in Africa at Alpine Heath, South Africa, on March 16-17, 2001.

Invited keynote speaker on “The molecular physiology of zinc uptake and accumulation in a metal hyperaccumulating plant species” at the 2001 Keystone Symposium on Plant Foods for Human Health held in Breckenridge, CO, on April 6-10, 2001.

Invited keynote speaker on “Signal transduction networks in plants: How do plants mine the soil?” at the Francqui Foundation Conference on Information processing Systems in Plants held at the University of Antwerpen, Belgium, June 8, 2001.

Invited keynote speaker on “How roots mine the soil: Genes, signaling networks and the whole plant” at the 75th Anniversary of ASPB Symposium – Plant Physiology 2000: Breaking the Mold, held in Providence, RI, July 21, 2001.

Invited keynote speaker on “ Heavy metal and aluminum resistance in plants: Similarities and differences” at the 14th International Plant Nutrition Colloquium in Hannover, Germany, July 26-Aug 2, 2001.

Invited speaker on “How do roots mine the soil for heavy metals and micronutrients?” at the ASA/CSSA Symposium on Root Effects on Soil Properties, Properties and Organisms, Charlotte, NC, October 24, 2001.

Invited keynote speaker on “An integrated molecular, genetic and physiological analysis of plant aluminum tolerance” at the 10th International Plant, Animal, and Microbes Genome Conference, San Diego, CA, January 12-16, 2002.

Invited seminar speaker on “A molecular analysis of heavy metal uptake and accumulation using a metal hyperaccumulating plant species” to the Division of Biological Sciences, Washington State University, Pullman, WA, February 4, 2002.

Invited seminar speaker on "Molecular and physiological investigations of plant micronutrient accumulation and tolerance to toxic metals" to the USDA-ARS Appalachian Fruit Research Station in Kearneysville, WV, on May 1, 2002.

Invited keynote speaker on “Molecular, genetic and physiological investigations of crop aluminum tolerance mechanisms” at the McKnight Foundation sponsored International Workshop on Adaptation of Crops to Low-Phosphorus Soils in the Tropics and Subtropics: Innovative Approaches for Sustainable Development, held in Guangzhou, China, May 6-11, 2002.

Invited symposium speaker on the topic of plant heavy metal uptake and tolerance for an international symposium entitled “Molecular level processes controlling availability of chemical species to plants and microbes” held in Haldkdiki, Greece, on June 23-28, 2002 (invitation declined).

Invited symposium speaker on “Investigating the molecular physiology of heavy metal accumulation and tolerance using *Thlaspi caerulescens* as a model system” at the 9th New Phytologist Symposium – Heavy Metals and Plants: From Ecosystems to Biomolecules, held at the University of Pennsylvania, Philadelphia, PA, from September 29-October 1, 2002.

Invited seminar speaker on “Molecular, genetic and physiological investigations of aluminum tolerance mechanisms in plants” jointly hosted by the Horticulture Department and the Plant Physiology Graduate Group at Penn State University, Oct 18, 2002.

Invited seminar speaker on “Molecular, genetic and physiological investigations of aluminum

tolerance mechanisms in plants” to the Interdisciplinary Plant Molecular Biology Graduate program at Texas A&M University on November 14, 2002.

Invited seminar speaker on “Understanding how plants mine the soil: from genes to whole plant function”, Boyce Thompson Institute for Plant Research, Cornell University, on December 16, 2002

Invited speaker on “Identification and characterization of Al tolerance loci in *Arabidopsis thaliana* by quantitative trait locus mapping: Physiologically simple but genetically complex” at the Abiotic Stress Symposium, XI International Plant and Animal Genome Meetings, San Diego, CA, January 12, 2003.

Invited seminar speaker on "Understanding how plants mine the soil: From genes to whole plant function" to the Horticulture Department at Cornell University, Ithaca, NY on February 24, 2003.

Invited speaker on “Investigating mechanisms of heavy metal hyperaccumulation using *Thlaspi caerulescens* as a model plant system” at the EPS/NSF Star Grant Awardee Program, US EPA International Phytotechnologies Conference, Chicago, IL, March 3, 2003.

Invited seminar speaker on " Molecular and physiological investigation of mineral and metal stress tolerance in plants", Department of Plant Breeding, Cornell University, Ithaca, NY on April 1, 2003.

Invited keynote speaker on "Insights into fundamental plant processes associated with phytoremediation of metal-contaminated soils: Research on the metal hyperaccumulator, *Thlaspi caerulescens*" for Horticulture Department faculty retreat, Purdue University, April 23, 2003.

Invited seminar speaker on “Investigating mechanisms of heavy metal hyperaccumulation using *Thlaspi caerulescens* as a model plant system” to Pohang University of Science and Technology, Pohang, S. Korea, December 9, 2003.

Invited keynote speaker on “Improving crops for agriculture on marginal soils: Research into crop aluminum tolerance as an example” at the international symposium entitled “Future Directions for Plant Biotechnology and Environmental Microbiology” held at the Biotechnology Research Center at the University of Tokyo, Japan on December 12, 2003.

Was selected by Dr. Knipling to speak at the Excellence of our Past session of the 2004 ARS National Leadership Conference (January 21-23, 2004). The session involved talks where “ARS Hall of Fame and other excellent ARS Scientists tell their stories, led by a moderator and a facilitator”.

Invited keynote speaker on "Using an integrated genomic, genetic and physiological approach to elucidate aluminum tolerance genes and mechanisms in plants" at the 6th International Symposium of Plant-Soil Interactions at Low pH held in Sendai, Japan, from Aug 1-5, 2004.

Invited keynote speaker on "Recent progress on Al tolerance research in plants" at the 3th International Kurashiki Symposium of Plant Al Tolerance, Kurashiki, Japan, from Aug 6-7, 2004.

Invited speaker on "Aluminum tolerance mechanisms and the underlying genes in cereal crop species" at Zhejiang University, Hangzhou, China, on October 28, 2004.

Invited speaker on "Investigating the molecular and physiological basis for aluminum tolerance using arabidopsis as a model plant system" at Zhejiang University, Hangzhou, China, on October 28, 2004.

Invited speaker on "Molecular analysis of heavy metal uptake and accumulation using a metal hyperaccumulating plant species" at Zhejiang University, Hangzhou, China, on October 29, 2004.

Invited speaker on "Harvesting health: Linking agricultural crop production to enhanced human nutrition" at Zhejiang University, Hangzhou, China, on October 29, 2004.

Invited speaker on "Writing research papers for publication in good journals (like Plant Physiology)" at Zhejiang University, Hangzhou, China, on October 29, 2004.

Invited speaker on "The molecular and physiological basis for aluminum tolerance in plants" at the Nanjing Soil Science Institute, Chinese Academy of Science, Nanjing, China, on November 1, 2004.

Invited speaker on "Molecular analysis of heavy metal uptake and accumulation using a metal hyperaccumulating plant species" at the Nanjing Soil Science Institute, Chinese Academy of Science, Nanjing, China, on November 1, 2004.

Invited speaker on "Harvesting health: Linking agricultural crop production to enhanced human nutrition" at Shanghai Institute of Plant Physiology and Ecology, Shanghai, China, on November 3, 2004.

Invited speaker on "Functional and comparative genomic analysis of aluminum tolerance in Zea mays" at the Abiotic Stress Symposium, 13th International Plant and Animal Genome meetings, San Diego, CA, January 16, 2005.

Invited seminar speaker on "Aluminum tolerance genes and associated physiological mechanisms in cereal crop species and Arabidopsis" for the Interdisciplinary Plant group, University of Missouri, Columbia, MO on February 7, 2005.

Invited keynote speaker on "Aluminum tolerance in cereal crops – Mechanisms and genes" at the McKnight Foundation meeting on Acid Soil Research, Embrapa Maize and Sorghum Research Institute, Sete Lagoas, Brazil, February 21, 2005.

Invited seminar speaker on “Aluminum tolerance genes and associated physiological mechanisms in cereal crop species and *Arabidopsis*” for the Department of Plant Pathology, Kansas State University, Manhattan, Kansas March 17, 2005.

Invited symposium speaker on “Investigating Molecular/Physiological Mechanisms of Plant Heavy Metal Accumulation using *Thlaspi caerulescens* as a Model Plant System” at the 3rd International Phytotechnologies Conference, Atlanta, GA, April 20-22, 2005.

Invited keynote speaker on “High resolution mapping and cloning of *AltSB*, a major aluminum tolerance gene in sorghum” and Chair of the Heavy Metals and Phytoremediation Symposium at the American Society of Plant Biologists meeting, in Seattle, WA, July 18, 2005.

Plenary speaker on “Investigating molecular/physiological mechanisms of plant heavy metal accumulation using *Thlaspi caerulescens* as a model plant system” at the International Symposium on Phytoremediation and Ecosystem Health, Hangzhou, China, Sept 10-13, 2005.

Plenary speaker on “Integrating genomic, molecular genetic and physiological approaches to identify plant aluminum tolerance genes and their associated physiological mechanisms” at the 15th International Plant Nutrition Colloquium, Beijing, China, Sept 14-19, 2005.

Invited seminar speaker on “Aluminum tolerance genes and associated physiological mechanisms in crop and model plant species” for the Colloquium in the Life Sciences, Colorado State University, October 3, 2005.

Plenary speaker on “Physiological and Molecular mechanisms of aluminum resistance in crops” at the CIAT-Embrapa sponsored workshop “Advances in improving acid soil adaptation of tropical crops and forages, and management of acid soils” held in Brasilia, Brazil on October 18-21, 2005.

Invited speaker on “Map-Based Cloning And Characterization of *AltSB*, A Major Aluminum Tolerance Gene In Sorghum”. 14th International Plant and Animal Genome Meeting, San Diego, CA, January 18, 2006.

Invited seminar speaker on “High Resolution Mapping, Cloning and Characterization of a Major Aluminum Tolerance Gene Using Sorghum as a Model System”. Department of Plant Breeding, Cornell University, April 11, 2006.

Invited seminar speaker on “High resolution mapping, cloning and characterization of a major aluminum tolerance gene using sorghum as a model system” at the Plant Biology Graduate program Seminar Series, University of Massachusetts, Amherst, MA. May 4, 2006.

Invited speaker on “Molecular, Genetic, and Physiological Analysis of *AltSB* - A Major Aluminum Tolerance Gene Recently Identified in Sorghum” at the 23rd Annual Missouri Symposium: Plant Roots: From Genes to Form and Function, at the University of Missouri, Columbia, MO, May 24-26, 2006.

Invited speaker on “Molecular, genetic and physiological analysis of Alt_{SB} – A major aluminum tolerance gene recently identified in sorghum” at the International Symposium in Memory of Vincent R. Francheschi, Washington State University, Pullman WA, June 7-12, 2006.

Keynote Speaker on “Isolation and Characterization of Aluminum Tolerance Genes in the Cereals: An Integrated Functional Genomic, Molecular Genetic and Physiological Analysis “ at the International Generation Challenge Program meeting, Sao Paulo, Brazil. Sept 12-17, 2006.

Keynote speaker on “Using Genomic and Genetic Approaches to Elucidate Aluminum Resistance Genes and Mechanisms in Crop Plants” at the International Symposium on Plant Nutrition meets Plant Breeding, Hohenheim University, Stuttgart, Germany, Sept 25-28, 2006

Invited speaker on “Investigating the Genetic Basis for Maize Seed Fe Bioavailability and Content” at HarvestPlus Workshop on Improving Crops for Human Nutrition, Beltsville, MD, Jan 8-10, 2007.

Invited workshop speaker on "Elucidating the Molecular Determinants of Aluminum Tolerance in Sorghum and Maize" at the Challenge Program: Unlocking Crop Genetic Diversity for the Poor Workshop, Plant and Animal Genome XV, San Diego, CA, Jan 15, 2007.

Invited seminar speaker on “High Resolution Mapping, Cloning and Characterization of a Major Aluminum Tolerance Gene Using Sorghum as a Model System”, Section of Plant Biology, University of California, Davis, Jan 26, 2007.

Invited seminar speaker on “Identification and Characterization of a Key Aluminum Tolerance Gene Using Sorghum as a Model System”, The Noble Foundation, Ardmore, OK, April 11, 2007.

Annals of Botany Keynote lecture on “The Molecular Biology of Plant Metal Transporters” at the 9th International Conference on the Biogeochemistry of Trace Elements, Beijing, China, July 12-16, 2007.

Invited Keynote speaker on “Crop Aluminum Tolerance: Molecular and Genetic Investigations of a Rhizosphere-Mediated Agronomic Trait”, Rhizosphere 2 Symposium, Montpellier, France, August 25-31, 2007.

Invited Keynote speaker on “Maize aluminum tolerance research: An integrated genetic, genomic and physiological analysis” at the 2007 Annual Research meeting of the Generation Challenge Program, Johannesburg, South Africa, September 12-16, 2007.

Invited Keynote speaker on “Aluminum tolerance in sorghum: Molecular, genetic and physiological basis” at the 2007 Annual Research meeting of the Generation Challenge Program, Johannesburg, South Africa, September 12-16, 2007.

Invited seminar speaker on “Map-Based Cloning and Characterization of a Novel Aluminum Tolerance Gene in Sorghum Encoding an Al-Activated Citrate Transporter”, Department of Horticulture, Cornell University, October 1, 2007.

Invited seminar speaker on “Map-Based Cloning and Characterization of a Novel Aluminum Tolerance Gene in Sorghum Encoding an Al-Activated Citrate Transporter”, Delaware Biotechnology Institute, University of Delaware, October 18, 2007.

Invited speaker on “Identification and characterization of novel aluminum tolerance genes in cereal crops”, USA-Pakistan Symposium on Plant Stress Biology, University of California, Davis, November 4-5, 2007.

Kochian LV and Magalhaes JV (2008) Isolation and Characterization of Aluminum Tolerance Genes in the Cereals: An Integrated Functional Genomic, Molecular Genetic and Physiological Analysis. Challenge Program Workshop: Unlocking Crop Genetic Diversity for the Poor Workshop, Plant and Animal Genome XVI Meeting, Jan 14, 2008, San Diego, CA,

Liu J, Magalhaes JV, and Kochian LV (2008) Aluminum-activated citrate and malate transporters encoded by distinct Al tolerance genes function independently in Arabidopsis. Root Genomics Workshop, Plant and Animal Genome XVI Meeting, Jan 15, 2008, San Diego, CA

Kochian LV and Magalhaes JV (2008) Positional Cloning and Association Analysis of a MATE Gene that Confers Aluminum Tolerance in Sorghum via the *Alt_{SB}* Locus. Sorghum and Millets Workshop. Plant and Animal Genome XVI Meeting, Jan 16, 2008, San Diego, CA,

Keynote speaker on “How Plants Cope with Toxic Metals: Aluminum Tolerance as an Example” at the 72nd Annual Meeting for the Northeast Section-American Society of Plant Biologists, April 18-19, 2008, University of Connecticut, Storers, CT,

Host and Lead Speaker for the Dedication Ceremony for the Robert W. Holley Center for Agriculture and Health, a commemorative event renaming and rededicating the US Plant, Soil and Nutrition Laboratory, May 12, 2008. Cornell University, Itahca, NY.

Keynote speaker on “Recent Advances on the Molecular Basis of Crop Aluminum Tolerance Using Sorghum as a Model System“ for the Symposium Commemorating the 10th Anniversary of the Agricultural Biotechnology Research Center, Academia Sinica. April 29 - May 1, 2008, Tapei, Taiwan.

Invited speaker on “Screening maize populations for iron content and bioavailability using RILs – methods and findings to date” at the HarvestPlus Technical Meeting on *Improving Bioavailability of Minerals from Biofortified Staple Food Crops*, March 31-April 2, 2008. IFPRI headquarters, Washington, DC.

Keynote speaker on “Elucidating the Molecular Basis of Crop Aluminum Tolerance Using Sorghum as a Model System” at the COMBIO 2008 Conference, September 21-25, 2008, Canberra, Australia.

Invited speaker in the *Cellular Ion Transport Symposium* on “Structure-Function Analysis of ALMT Transporters Involved in Crop Aluminum Tolerance” at the COMBIO 2008 Conference, September 21-25, 2008, Canberra, Australia.

Invited speaker on “Molecular Strategies for Crop Aluminum Tolerance”, Root Biology Center, South China Agricultural University, January 27, 2009, Guangzhou, China.

Invited speaker on “Organic Acid Transporters that Function in Crop Aluminum Tolerance: Structure-Function Investigations of Transporter Properties Important for Aluminum Tolerance”, Root Biology Center, South China Agricultural University, January 28, 2009, Guangzhou, China,

Keynote opening address at 8th International Symposium on Plant-Soil Interactions at Low pH held in Guangzhou, China on May 18-23, 2009. Address was entitled “Molecular and Physiological Basis for Crop Aluminum Resistance”.

Plenary address entitled “Adaptive strategies for plant response to toxic metals in the soil” at the XVI International Plant Nutrition Colloquium in Sacramento, CA on August 26-30, 2009.

Plenary Speaker on “Molecular and genetic dissection of aluminum tolerance in maize and sorghum” at the Generation Challenge Program Annual Research Meeting in Bamako, Mali on September 19-23, 2009.

Invited speaker on “Elucidating the molecular basis for cereal aluminum tolerance” at the Abiotic Stress Symposium, International Plant Molecular biology Congress, St. Louis, MO, October 26-30, 2009.

Keynote opening address at the XIII National Congress of Biochemistry and Plant Molecular Biology and 6th Mexico-USA Plant Biology Symposium, Guanajuato, Mexico, November 9-13, 2009. Keynote address was entitled “Strategies Plants Employ to Cope with Toxic Metals: Crop Aluminum Tolerance as a Model”.

Kochian LV. 2010. “Elucidating the molecular and genetic basis for aluminum tolerance in sorghum, maize and rice” Challenge Program Workshop, Plant and Animal Genome XVIII Meeting, Jan 11, 2010, San Diego, CA

Invited seminar speaker, Department of plant Biology, University of Minnesota. Seminar title: “Molecular, Genetic and Physiological Analysis of Crop Aluminum Tolerance”. February 2, 2010.

Invited speaker at the San Diego Center for Molecular Agriculture 10TH Anniversary Symposium: Nutrient Sensing And Capture with the talk entitled “Overcoming Aluminum toxicity”, San Diego, CA, February 11, 2010.

Invited speaker on “Fighting fire with fire: Plants tolerate acid soils by releasing organic acids”

at the Roots of Agriculture Symposium at the 2010 AAAS meeting, San Diego, CA, February 19, 2010.

Opening keynote speaker at the 2010 Plant Biotech Denmark Symposium with the talk entitled “Adaptive strategies for plant responses to toxic metals in the soil”, Copenhagen, Denmark, March 4, 2010.

Organizer and leader of GCP Comparative Genomics Challenge Initiative Kickoff Meeting, Moi University, Eldoret, Kenya, May 17-19, 2010.

Invited seminar speaker on “Adaptive strategies for plant responses to toxic metals in the soil”, Biology Department, Yerevan State University, Yerevan, Armenia, June 3, 2010.

Invited speaker on “Genome wide analysis of root traits” at the NSF Plant Genome Awardees meeting, Arlington, VA, September 9-10, 2010.

Invited keynote speaker on “Molecular analysis of Zn transport and homeostasis using a metal hyperaccumulating plant species” at the Genetics of Plant Mineral Nutrition Symposium, Hannover, Germany, September 30-October 2, 2010.

Invited seminar speaker on “Biochemical and Molecular Regulation of Sorghum Aluminum Tolerance Involving the Root Citrate Transporter, SbMATE”, Institute of Plant Science and Resources, Okayama University, Japan, October 29 and 31, 2010 (two talks).

Invited seminar speaker on “Molecular and Genetic Regulation of Cereal Aluminum Tolerance”, Department of Soil Science and Agricultural Chemistry, University of Agricultural Sciences, Bangalore, India, November 29, 2010.