

CURRICULUM VITAE

GERALD A. BERKOWITZ

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Education: **Brandeis University**, Institute for Photobiology of Cells and Organelles
PhD 1983, Major- Plant Physiology
Texas Tech University, Department of Plant and Soil Science
MS 1980, Major- Crop Physiology, Minor- Statistics and Chemistry,
Cornell University, College of Agric. & Life Sciences, BS 1977, Major- Agronomy

Employment

(9/09-present): Professor, Department of Plant Science and Land. Arch., University of Connecticut
(9/07-9/09) Program Director, Physiological Systems, Division of Integrative Organismal Systems, Biology Directorate, National Science Foundation
(9/02-9/07): Professor, Department of Plant Science, University of Connecticut
(9/01-9/02): Program Director, Cell Biology, Division of Molec. & Cellular Biosci., Biology Directorate National Science Foundation
(4/96-9/01): Professor and Department Head, Dept. Plant Science, University of Connecticut
(7/94-4/96): Professor, Plant Sci. Dept., Rutgers Univ., Director, Plant Sci. & Technology Grad. Program
(7/83-7/94): Assistant, then Assoc. Professor, Plant Science Dept., Rutgers University

Awards: 2018 College of Agric. Health & Nat. Res. Teacher Excellence; 2009 College of Agric., Health & Nat. Resources Research Excellence; 1992 Johnson & Johnson Discovery Research Award; 1993 Cook College Research Excellence Award.

Honors: Invited Conference Presentations: 2022 New England Cannabis Re. & Ed. Conf., 1997, 1999, 2003, 2004, 2006, 2008, 2009, 2010, 2011, 2012, 2013, 2015 Amer. Soc. Plant Biol. (ASPB) Natl. Mtg., Int. Plant Ca²⁺ Signaling Sym. 2014, 2017; Amer Soc. Agron. Natl. Mtg. 1996
Invited Gordon Conf. lectures: 1982 (CO₂ Fixation), 1987 (Mg²⁺ in Biochemical Processes and Medicine), 2002 (Water & Salt Stress in Plants), 2004 (Water & Salt Stress in Plants).
Invited moderator: ASPB natl. mtg. sessions: signaling (2013) water stress (1987), heat stress (1991), membranes (2002), transport (2003), membrane transport (2004)
Invited federal grant review panel/study section member: 1993 DOE Energy Biosci. Div. Photosyn., 1995 USDA-NRI Plant Response to Environment, 2001 & 2002 NSF Cell Biol., 2003 NIH plant-derived therapeutics, 2004 & 2005 NSF Minority Postdoctoral Research, 2004 NSF Neuronal & Glial Mechanisms and Signal Transduction, 2004 NIH Minority Institutional Training Grants, 2005 NSF Signal Transduction, 2010 NSF Climate Change & Biology, 2010 NSF Signal Transduction, 2010 NSF Cellular Homeostasis, 2011 NSF Cellular Homeostasis, 2012 NSF Symbiosis & Defense; 2013 USDA AFRI Biol. Agric. Plants; 2015 USDA AFRI Post-Doc Fellowship

Editorial Boards: Frontiers Plant Science; Plant Sig & Behav; The Open Nitric Oxide Jour; Plants

Prof. Societies: American Society for Plant Biology

Courses taught: (undergrad)- biotechnology, agricultural technology & society, vegetable production, organic agriculture, cannabis horticulture, agriculture & environment; (graduate)- plant physiology, plant water relations, plant analysis techniques, seminar

Research interests: ion channels, pathogen defense, Ca²⁺ signaling, cannabis molecular biology

Publications: refereed journals and invited book chapters- >100 total

Ma G, Zielinski R, Ma, Y, Berkowitz GA 2023 Real-time imaging of Ca²⁺ signaling in Arabidopsis thaliana and

- Cannabis sativa* L. using plasma membrane localized Ca²⁺ sensor GCaMP6pm and association of Ca²⁺ signaling with protoplast volume changes upon hormone and peptide perception. *Plants*. In preparation.
- Zelman AK, Huffaker A, Ma Y, Berkowitz GA 2023 Pep signaling in tomato activates Ca²⁺ mediated elements of pathogen defense pathway. *Plants*. In preparation.
- Zelman AK, Berkowitz GA 2023 Plant elicitor peptide (Pep) signaling and pathogen defense in tomato (review). *Plants*. Under review.
- Sands LB, Haiden SR, Ma Y, Berkowitz GA. 2023 Hormonal control of promoter activities of *Cannabis sativa* prenyltransferase 1 and 4 and salicylic acid mediated regulation of cannabinoid biosynthesis. *Sci Rep* 13:8620 doi.org/10.1038/s41598-023-35303-4
- Ma Y, Ali R, Garrido K, Berkowitz GA 2022 Phenotypes of *Arabidopsis* cyclic nucleotide-gated channel null mutants: probing the nature of native protein complexes. *Plant J* 113:1223-1236. <https://doi.org/10.1111/tpj.16106>
- Sipahi H, Whyte TD, Ma G, and Berkowitz GA 2022 Genome-wide identification and expression analysis of wall-associated kinase (WAK) gene family in *Cannabis sativa* L. *Plants* 11:2703 <https://doi.org/10.3390/plants11202703>
- Ma G, Apicella PV, Ma Y, Berkowitz GA 2022 The cannabis jamonate-independent homeodomain zipper family IV gene HDG5 functions in trichome morphogenesis and is involved in immune-related phenotypes when expressed in tobacco. *Plant Mol. Biol.* in preparation.
- Ma G, Zelman AK, Apicella PV, Berkowitz GA 2022 Genome-wide identification and expression analysis of homeodomain leucine zipper subfamily IV (HD-ZIP IV) gene family from *cannabis sativa* L. *Plants* 11:13078 <https://doi.org/10.3390/plants11101307>
- Sands L, Cheek T, Reynolds J, Ma Y, Berkowitz GA 2022 Growth enhancement and disease resistance in *Cannabis sativa* from PAMPs: Flg22 and Harpin. *Plants* 11:1178. <https://doi.org/10.3390/plants11091178>
- Apicella PV, Sands L, Ma Y, Berkowitz GA 2022 Delineating genetic regulation of cannabinoid biosynthesis during female flower development in *Cannabis sativa*. *Plants Direct* 6:e412 <https://doi.org/10.1002/pld3.412>
- Haiden SR, Apicella PV, Ma Y, Berkowitz GA 2022 The characterization of CsMIXTA, a novel transcription factor in *Cannabis sativa* that influences glandular trichome morphogenesis. *Plants* 11:1519; <https://doi.org/10.3390/plants11111519>
- Shehzad K, Shah ZH, Khan S, Alsamadani H, Rauf M, Alzahrani H, Alzahrani Y, Ahmed M, Habib I, Berkowitz GA, Mansoor S, Saeed N 2021 Heterologous expression of a barley homologue Na⁺/K⁺ transporter from *Leptochloa fusca* showed ion permeability and salt tolerance. *Internatl J Molec Sci* (submitted)
- Yu X, Xu G, Li B, de Souza Vespoli L, Liu H, Moeder W, Chen S, de Oliveira MVV, Araidina de Souza S, Shao W, Rodrigues B, Ma Y, Chhajed S, Xue S, Berkowitz GA, Yoshioka, K, He P, Shan L 2019 The receptor kinases BAK1/SERK4 regulate Ca²⁺ channel homeostasis for cell death containment. *Current Biol* 29: 3778-3790. doi: 10.1016/j.cub.2019.09.018
- Ma Y, He K, Berkowitz GA 2019 An Overview: From Structure to Signalsomes; new perspectives about membrane receptors and channels. *Frontiers Plant Sci* 10:682 doi: 10.3389/fpls.2019.00682
- McGehee C, Apicella P, Berkowitz G, Durocher S, Ma Y, Lubell J 2019 First report in United States of *Pythium myriotylum* on hemp (*Cannabis sativa* L.) in Storrs, Connecticut. *Plant Disease Reports* 103:3288. doi.org/10.1094/PDIS-11-18-2028-PDN
- Zheng X, Kang S, Jing Y, Ren Z, Li L, Zhou J-M, Berkowitz GA, Shi J, Lan W, Zhao F, Luan S 2018 Danger-Associated Peptides Close Stomata by OST1-Independent Activation of Anion Channels in Guard Cells. *Plant Cell* 30: 1132-1146 (doi:10.1105/tpc.17.00701)
- Ma Y, Berkowitz GA 2017 Multimeric CAX complexes and plant cell Ca²⁺ signaling. (eXtra Botany Insight) *J Exp Bot* 68:3997-3999. PMID: 28922775. DOI: 10.1093/jxb/erx227
- Ma Y, Zhao Y, Berkowitz GA 2017 Intracellular Ca²⁺ is important for flagellin-triggered defense in *Arabidopsis* and involves inositol polyphosphate signaling. *J Exp Bot* 68:3617-3628. PMID: 28595359 DOI: 10.1093/jxb/erx176
- Ma Y, Berkowitz GA 2017 Biotic stress signaling: Ca²⁺ mediated pathogen defense programs. In: S. Shabala,

- ed, Plant Stress Physiology, edition 2. CAB International, Wallingford, UK. Pgs. 332-351
- Chou H, Wang H, Berkowitz GA 2016 Shoot apical meristem size measurement. Bio-Protocol DOI: <https://doi.org/10.21769/BioProtoc.2055>
- Ma Y, Berkowitz GA 2016 NO and Ca²⁺: critical components of cytosolic signaling systems involved in stomatal immune responses pp 285-323. In: D. Wendehenne, ed., Nitric Oxide and Signaling in Plants, Adv Bot Res 77. Elsevier, NY pgs.286-323. ISBN 9780128010747 doi: 10.1016/bs.abr.2015.11.001
- Chou H, Zhu Y, Ma, Y, Berkowitz GA 2016 The CLAVATA signaling pathway mediating stem cell fate in shoot meristems requires Ca²⁺ as a secondary cytosolic messenger. Plant J 85: 494-506
- Shahzad K; Rauf M; Ahmad M; Malik ZA; Habib I; Ahmed Z, Mahmood K, Ali R; Masmoudi K; Lemtiri-Chlieh F; Gehring C; Berkowitz GA; Saeed N 2015 Functional characterization of an intron retaining K⁺ transporter of barley reveals intron mediated alternate splicing. Plant Biol 17: 840-851 doi:10.1111/plb.12290.
- Rauf M, Shehzad K, Ali R, Ahmad M, Habib I, Mansoor S, Berkowitz GA, and Nasir A Saeed NA 2014 Cloning and characterization of Na⁺/H⁺ antiporter (*LfNHX1*) gene from a halophyte grass *Leptochloa fusca* for drought and salt tolerance. Mol Biol Rep 41:1669-1682. doi: 10.1007/s11033-013-3015-3.
- Ma Y, Zhao Y, Walker RK, Berkowitz GA 2013 Molecular steps in the immune signaling pathway evoked by plant elicitor peptides: Ca²⁺-dependent protein kinases, nitric oxide, and reactive oxygen species are downstream from the early Ca²⁺ signal. Plant Physiol 163:1459-1471
- Zhao Y, Zhi Q, Berkowitz GA 2013 Teaching an old hormone new tricks: cytosolic Ca²⁺ elevation involvement in plant brassinosteroid signal transduction cascades. Plant Physiol 163:555-565
- Jeandroz S, Lamotte O, Astier J, Rasul S, Trapet P, Besson-Bard A, Bourque S, Nicolas-Francis Ma W, Berkowitz GA, Wendehenne D 2013 There's more to the picture than meets the eye: Nitric oxide cross-talk with Ca²⁺ signaling. Plant Physiol 163:459-470
- Walker RK, Berkowitz GA 2013 Detection of reactive oxygen species down-stream of cyclic nucleotide signals in plants. Meth Mol Biol 1016:245-252
- Zelman AK, Dawe A, Berkowitz GA 2013 Identification of cyclic nucleotide gated channels using regular expression. Cyclic nucleotide signaling in plants. Meth Mol Biol 1016: 207-224
- Ma Y, Walker RK, Zhao Y, Berkowitz GA 2012 Linking ligand perception by the PEPR pattern recognition receptors to cytosolic Ca²⁺ elevation and downstream immune signaling in plants. Proc Natl Acad Sci USA 109:19852-19857
- Zelman AK, Dawe A, Gehring C, Berkowitz GA 2012 Evolutionary and structural perspectives of plant cyclic nucleotide-gated cation channels. Frontiers Plant Sci 3:95
- Ma Y, Berkowitz GA 2012 Biotic stress signaling: Ca²⁺ mediated pathogen defense programs. In: S Shabala, ed, Plant Stress Physiology. CAB International, Wallingford, UK. Pgs. 291-309
- Eckhardt NA, Berkowitz GA 2011 In brief: Review of Functional analysis of *Arabidopsis* NHX antiporters: the role of the vacuole in cellular turgor and growth. Plant Cell. 23:1-2
- Ma Y, Berkowitz GA 2011 Danger at your door: pathogen signals and programmed cell death in plants. New Phytol 192:1-3
- Berkowitz GA, Gehring C, Irving HR, Kwezi K 2011 Reply to Ashton: The putative guanylyl cyclase domain of AtPepR1 and similar plant receptors. Proc Natl Acad Sci USA 108:E97-E98
- Ma W, Berkowitz GA 2011 Cyclic nucleotide gated channels and calcium signaling. In: S Luan, ed, Coding and Decoding of Calcium Signals in Plants. Springer-Verlag. Berlin Heidelberg. Pgs. 93-110
- Ma W, Berkowitz GA 2011 Ca²⁺ conduction by plant cyclic nucleotide-gated channels and associated signaling components in pathogen defense signal transduction cascades. New Phytol 190:566-572
- Ma W, Berkowitz GA 2011 Cyclic nucleotide gated channels and Ca²⁺-mediated signal transduction during plant senescence signaling. Plant Sig Behav 6: 413-415
- Qi Z, Verma R, Gehring C, Yamaguchi Y, Zhao, Y, Ryan C, Berkowitz GA 2010 Ca²⁺ signaling by plant AtPep peptides depends on AtPepR1, a receptor with guanylyl cyclase activity, and cGMP activated Ca²⁺ channels. Proc Natl Acad Sci USA 107:21193-21198
- Ma W, Smigel A, Walker, RK, Moeder W, Yoshioka K, Berkowitz GA 2010 Leaf senescence signaling: Ca²⁺ accumulation mediated by Arabidopsis cyclic nucleotide gated channel2 acts through nitric oxide to repress senescence programming. Plant Physiol 154:733-743

- Ma W, Yoshioka K, Gehring CA, Berkowitz GA 2010 The function of cyclic nucleotide gated channels in biotic stress. In: V Demidchik and FJM Maathuis, eds, *Ion Channels and Plant Stress Responses*. Springer-Verlag Berlin Heidelberg. Pg. 159-174.
- Ma W, Qi Z, Smigel A, Walker RK, Verma R Berkowitz GA 2009 Ca²⁺, cAMP and transduction of non-self perception during plant immune responses. *Proc Natl Acad Sci USA* 106:20995-21000
- Ma W, Smigel A, Verma R, Berkowitz GA 2009 Cyclic nucleotide gated channels and related signaling components in plant innate immunity. *Plant Sig Behav* 4:277-282
- Ma W, Smigel A, Tsai Y-C, Braam J, Berkowitz GA 2008 Innate immunity signaling: cytosolic Ca²⁺ elevation is linked to downstream nitric oxide generation through the action of calmodulin or a calmodulin-like protein. *Plant Physiol* 148:818-828
- Urquhart W, Arunika N, Gunawardena AN, Moeder W, Ali R, Berkowitz GA, Yoshioka K 2007 The chimeric cyclic nucleotide gated ion channel ATCNGC11/12 constitutively induces programmed cell death through calcium ions. *Plant Mol Biol* 65:747-761
- Ma W, Yoshioka K, Berkowitz GA 2007 Cyclic nucleotide gated channels and Ca²⁺-mediated signal transduction during plant innate immune response to pathogens. *Plant Sig Behav* 2:548-550
- Ma W, Berkowitz GA 2007 The grateful dead: Calcium and cell death in plant innate immunity. *Cellular Microbiology* 9:2571-2585
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- Brini F, M Hanin, I Mezghani, GA Berkowitz, K Masmoudi 2007 Overexpression of wheat Na⁺/H⁺ antiporter *TNHX1* and H⁺-pyrophosphatase *TVP1* improve salt and drought stress tolerance in *Arabidopsis thaliana* plants. *J Expt Bot* 58:301-308
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- Ma W, Ali R, Berkowitz GA 2006 Characterization of plant phenotypes associated with loss-of-function of the plant cyclic nucleotide gated cation channel AtCNGC1. *Plant Physiol Biochem* 44:494-505
- Yoshioka K, Moeder W, Kang H-G, Kachroo P, Masmoudi K, Berkowitz GA, Klessig DF 2006 The chimeric cyclic nucleotide-gated ion channel AtCNGC11/12 activates multiple pathogen resistance responses. *Plant Cell* 18:747-763
- Ali R, Zielinski R, Berkowitz GA 2006 Expression of plant cyclic nucleotide gated channels in yeast. *J Expt Bot* 57:125-138
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- Hua B-G, Mercier RW, Leng Q, Berkowitz GA 2003 Plant do it differently: a new basis for K/Na selectivity in the pore of an ion channel. *Plant Physiol* 132:1353-1361
- Hua B-G, Mercier RW, Zielinski RE, Berkowitz GA 2003 Functional interaction of calmodulin with a plant cyclic nucleotide gated cation channel. *Plant Physiol and Biochem* 41:945-954 (cover article)
- Leng Q, Mercier R, Hua B-G, Fromm H, Berkowitz GA 2002 Electrophysiological analysis of cloned cyclic nucleotide gated ion channels. *Plant Physiol* 128:400-410 (cover article)
- Berkowitz GA, Mercier R, Leng Q, Hua B-G 2002 Plant K⁺ channel proteins. In, P Imas, ed, *Importance of potassium in nutrient management for sustainable crop production in India*. International Potash Institute
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- Leng Q, Mercier RW, Yao W, Berkowitz GA 1999 Cloning and first functional characterization of a plant cyclic nucleotide-gated cation channel. *Plant Physiol* 121:753-761
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- Berkowitz GA, J Ma, H Tang, X Zhang Z Fang, AC Vasconcelos 1999 Molecular analysis of plant K channel structure. In: D. Oosterhuis and GA Berkowitz, eds., *Frontiers in Potassium Nutrition: New Perspective on the Effects of Potassium on Crop Plant Physiology*. Potash and Phosphate Inst. Press, pp. 26-36. (invited chapter)
- Tang X, Vasconcelos AC, Berkowitz GA 1998 In vivo Expression pattern of a plant K⁺ channel β subunit protein. *Plant Sci* 134:117-128
- Peters JS, Berkowitz GA 1998 Characterization of the chloroplast inner envelope proton pump as a P-type ATPase. *Photosyn Res* 57:323-333
- Fang Z, Kamasani U, Berkowitz GA 1998 Molecular cloning and expression characterization of a rice K⁺ channel β subunit. *Plant Mol Biol* 37:597-606
- Berkowitz GA 1998 Water and salt stress. In, AS Raghavendra, ed., *Photosynthesis: A comprehensive treatise*. Cambridge Univ. Press, Cambridge, pp. 226-237 (invited chapter)
- Hadjeb N, Berkowitz GA 1996 Modified T-overhang protocol increases PCR product cloning efficiency. *BioTechniques* 20:20-22.
- Muramatsu H, Berkowitz GA, Nathan RD 1996 Characterization of a TTX-sensitive sodium current in pacemaker cells isolated from the rabbit sino atrial node. *Am J Physiol* 270:H2108-H2119
- Pedromo P, Murphy JA, Berkowitz GA, Funk CR 1996 Factors associated with summer stress performance of Kentucky Bluegrass genotypes. *HortSci* 31:1182-1186
- Tang H, Vasconcelos AC, Berkowitz GA 1996 Physical association of KAB1 with plant K⁺ channel β subunits. *Plant Cell* 8:1545-1553
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- Fang Z, Mi F, Berkowitz GA 1995 Molecular and physiological analysis of a thylakoid K⁺ channel protein. *Plant Physiol* 108:1725-1734
- Tang H, Vasconcelos AC, Berkowitz GA 1995 First evidence that plant K⁺ channel proteins have two different types of subunits. *Plant Physiol* 109:327-330
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- Gunasekera D, Santakumari M, Glinka Z, Berkowitz GA 1994 Wild and cultivated barley genotypes demonstrate varying ability to acclimate to plant water deficits. *Plant Sci* 99:125-134
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- Wang X, Berkowitz GA, Peters JS 1993 K⁺-conducting ion channel of the chloroplast inner envelope: Functional reconstitution into liposomes. *Proc Natl Acad Sci* 90:4981-4985
- Gunasekera D, Berkowitz GA 1993 Use of transgenic plants with Rubisco antisense DNA to evaluate the rate limitation of photosynthesis under water stress. *Plant Physiol* 103:629-635
- Berkowitz GA, Wu W 1993 Magnesium, K⁺ flux and photosynthesis. *Magnesium Res* 6:257-265 (invited review article)
- Gunasekera D, Berkowitz GA 1992 Heterogenous stomatal closure in response to leaf water deficits is not a universal phenomenon. *Plant Physiol* 98:660-665
- Wu W, Berkowitz GA 1992 Stromal pH and photosynthesis are affected by electroneutral K⁺ and H⁺ exchange through chloroplast envelope ion channels. *Plant Physiol* 98:666-672
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- Nitzsche P, Berkowitz GA, Rabin J 1991 Development of a seedling-applied antitranspirant formulation to enhance water status, growth, and yield of transplanted bell pepper. *J Am Soc Hort Sci* 116:405-411
- Peters JS, Berkowitz GA 1991 Studies on the system regulating proton movement across the chloroplast envelope. Effects of ATPase inhibitors, Mg²⁺, and an amine anesthetic on stromal pH and photosynthesis. *Plant Physiol* 95:1229-1236
- Win K, Berkowitz GA, Henninger M 1991 Antitranspirant application increases leaf water potential, increases tuber calcium, and decreases tuber necrosis in water stressed potato plants. *Plant Physiol* 96:116-120
- Santakumari M, Berkowitz GA 1991 Chloroplast volume:water potential relationships and acclimation of photosynthesis to cellular water deficits. *Photosyn Res* 28:9-20
- Wu W, Peters JS, Berkowitz GA 1991 Surface charge mediated effects of Mg²⁺ on K⁺ flux across the chloroplast envelope are associated with regulation of stromal pH and photosynthesis. *Plant Physiol* 97:580-587
- Wu W, Berkowitz GA 1991 Lidocaine and ATPase inhibitor interaction with the chloroplast envelope. *Plant Physiol* 97:1551-1557
- Santakumari M, Berkowitz GA 1990 Correlation between the maintenance of photosynthesis and in situ protoplast volume at low water potentials in droughted wheat. *Plant Physiol* 92:733-739
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- Sen Gupta A, Berkowitz GA, Pier PA 1989 Maintenance of photosynthesis at low leaf water potential in wheat. Role of potassium status and irrigation history. *Plant Physiol* 89:1358-1365
- Pier PA, Berkowitz GA 1989 Effects of chloroplast envelope Mg²⁺, cation movement, and osmotic stress on photosynthesis. *Plant Sci* 65:45-53
- Santakumari M, Berkowitz GA 1989 The protoplast volume: water potential relationship and bound water fraction in spinach leaves. *Plant Physiol* 91:13-18
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- Sen Gupta A, Berkowitz GA 1987 Osmotic adjustment, symplast volume, and nonstomatally mediated water stress inhibition of photosynthesis in wheat. *Plant Physiol* 85:1040-1047
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Berkowitz GA, Gibbs M 1983 Reduced osmotic potential effects on photosynthesis. Identification of stromal acidification as a mediating factor. *Plant Physiol* 71:905-911

Berkowitz GA, Gibbs M 1983 Reduced osmotic potential inhibition of photosynthesis. Site specific effects of osmotically induced stromal acidification. *Plant Physiol* 72:1100-1109

Berkowitz GA, Chen C, Gibbs M 1983 Stromal acidification mediates in vivo water stress inhibition on nonstomatal-controlled photosynthesis. *Plant Physiol* 72:1123-1126

Berkowitz GA, Gibbs M 1982 Effect of osmotic stress on photosynthesis studied with the isolated spinach chloroplast. Site specific inhibition of the photosynthetic carbon reduction cycle. *Plant Physiol* 70:1535-1540

Berkowitz GA, Gibbs M 1982 Effect of osmotic stress on photosynthesis studied with the isolated spinach chloroplast. Generation and use of reducing power. *Plant Physiol* 70:1143-1148

Fankhauser H, Berkowitz GA, Schiff JA 1981 A nucleotide with the properties of adenosine 5' phosphoramidate from *Chlorella* cells. *Biochem Biophys Res Com* 101:524-532

Berkowitz GA, Hopper NW 1980 A method of increasing the accuracy of diffusive resistance porometer calibrations. *Ann Bot* 45:723-727

Competitive External Research Grants (pending):

Berkowitz GA, Sotzing G USDA-NRI Urban & Emerging Agriculture. Smart greenhouses: Developing electrochromic greenhouse cladding designed to transmit light wavelengths for optimal commercial hemp production. **\$696,992**

Vadas T, Berkowitz GA USDA Higher Education Challenge Grants. Innovation on Small Farms Through a Project-based Learning Curriculum. **\$719,756**

Competitive External Research Grants:

CTPharma Research Solutions, LLC **\$49,702**. Developing new biochemical and molecular genetic knowledge of cannabis; commercial application. 10/1/22-9/30/23

USDA NRI **\$600,000** Deciphering the Molecular Regulatory Mechanisms Controlling Trichome Development and Cannabinoid Biosynthesis in Hemp Plants. 4/1/2022-3/31/2025

UConn Research Excellence Program **\$25,000**, Hormone regulated transcriptional modulation of cannabinoid biosynthesis in *Cannabis sativa*. (NOTE THIS IS NOT AN EXTERNAL FUNDING SOURCE).

Fine Fettle, LLC/Eric Zachs **\$49,189**, Identification of transcription factor proteins and other factors that regulate trichome initiation and cannabinoid levels in *Cannabis*. 9/1/2020-8/31/2021

CTPharma **\$44,714**, Genetic and Physiological Factors that Rate-Limit Cannabinoid Biosynthesis and Trichome Development During Cannabis Flower Maturation (3/20-2/21)

Genius Fund Venture Capital, LLC, **\$933,303** 'Development of tissue culture and transformation technology to develop industrial hemp genotypes that maximize cannabidiol content while maintaining low THC levels (6/19-5/25)

USDA-NIFA Professional Development Opportunities for Secondary School Teachers Program **\$150,000**. Enhancing science literacy in genetic engineering through teacher professional development for student success. (3/1/19-2/28/22) PI JE Cushman; Co-PIs GA Berkowitz, M Fusco-Rollins, MR Kelly

Connecticut Pharmaceutical Solutions **\$30,124**. Molecular genetic studies of cannabis pathogen defense genes, disease resistance, cannabinoid production, and expression of cannabinoid synthesis pathway genes (1/19-12/19)

NSF-IOS **\$600,000**. Unraveling a new signaling pathway for brassinosteroids: use of a novel biosensor for localized cAMP elevation to link cyclic nucleotide, Ca²⁺ and plant steroid signal transduction. (7/18-6/21)

David Levine **\$25,000**. Gift in support of undergraduate research on hemp Cannabis

Northeast AgEnhancement Program **\$2,500**. Support for UConn CAHNR Extension 'Science of GMOs' web site. PI- S. Stearns. Co-PIs: Berkowitz, J. Bovay, V. Wallace, J. Allen, J. Bonelli, X. Tian, C. Bartholomew, D. Hirsch, M. Fusco (4/18)

Go-Pap Synthesis LLC **\$200,000** Development of a program aimed at manipulating cannabidiol generation in hemp-type *Cannabis sativa* L. plants and yeast (3/17- 2/19)

NSF-IOS **\$220,000**. Development of a Ca²⁺ sensor for cytosolic microdomains and a real-time cAMP

Sensor for plants. (6/15-9/18)

NSF-IOS: **\$492,000** "Translating extracellular ligand perception into a cytosolic Ca²⁺ signal: Characterizing the role plant elicitor peptides and their receptor play in innate immune responses" (3/11-6/15)

NSF **\$552,875**: Cyclic nucleotide gated Ca channels and non-self perception in plant pathogen defense responses. (4/09-3/12)

NSF **\$191,382**: Plant calcium conducting channels: linking molecular architecture to roles in innate immunity signal transduction. (9/07-4/09)

USDA-NRI (Equipment grant award) **\$20,000**: Expression studies by real-time polymerase chain reaction-request for equipment (PI: Susan von Bodman, Co-PIs: G. Berkowitz, R. Gaxiola, L. Silbart, M. McGrane (1/04)

Fulbright Alumni Initiatives Awards, **\$25,000**: Enhancing drought/salinity tolerance of wheat varieties indigenous to N. Africa: research, teaching & outreach (Co-PI Khaled Masmoudi) 6/04-1/07

USDA Secondary and two-year postsecondary agricultural education challenge grant, **\$40,000**: A learning module and lab manual to teach students how protein structure is related to function, at the molecular, cell, and whole plant level (Co-PI Jon Swanson). 4/04-8/05

NSF, **\$492,857**: Plant cyclic nucleotide gated channels: functional characterization using cloned channels and native plant membranes. 4/04-3/08

USDA Sci. Coop. Res. Prog. **\$60,000**: Improving salt tolerance of winter wheat in Tunisia. 9/01

USDA-NRI, **\$130,000**: Calmodulin, Ca & cAMP gated ion channels; unraveling a signal cascade in plants. 9/01

NSF, **\$412,776**: Plant cyclic nucleotide gated ion channels; structure: function analysis of a newly identified & unique family of proteins. 4/01

Yankee Ingenuity Initiative, Connecticut Innovations Inc., **\$141,886**: Genetic engineering of rhododendron for phytophthora resistance and phytophthora diagnostic assay development (co-PIs Mark Brand and Carol Auer) 7/98

NSF, **\$295,000**: Molecular and biochemical analysis of a plant K⁺ channel beta subunit 9/96

NSF, Multi-User Equipment Prog., **\$54,390**: An oocyte expression: patch/voltage clamp system for the system for the expression and analysis of genes encoding membrane channels and receptors 12/95

Department of Energy, Ener. Biosci. Program, **\$171,100**: Molecular analysis of a thylakoid K⁺ channel 9/95

USDA-NRI, **\$90,000**: Molecular characterization of a chloroplast envelope K⁺ channel and H⁺ pump ATPase 9/94

American Chemical Society "Project Seed" Economically Disadvantaged High School Student Summer Intern Program; **\$1,650**: Immunopurification of a plant membrane K⁺ channel 4/94

USDA Research Apprenticeship for Minority High School students, **\$2,400**: Preparation and use of an immunoaffinity column for the purification of plant K⁺ channel proteins 3/94

NSF, **\$50,000**: Design and testing of a generic K⁺ channel antibody 12/93

USDA-NRI **\$120,000**: K channel and envelope ATPase: a system regulating photosynthesis.9/92

Johnson & Johnson Discovery Research Program, **\$20,000**: "Purification of a K-conducting channel from chloroplast inner envelope" 4/92

USDA-NRI **\$100,000**: Chloroplast envelope components which regulate H⁺ & K⁺ transport 9/90

Aquatrols, **\$22,000**: "Antitranspirants to enhance quality & yield in water stressed potatoes. 6/88

N.J. Veg. Growers Assoc. **\$1,200**: "Can the use of an antitranspirant replace seedling hardening treatments as an effective means of protecting transplanted vegetable seedlings" 11/87

NSF, **\$150,000**: "Characterization of water deficit effects on chloroplast photosynthesis" (9/87)

N.J. Veg. Growers Assoc.: **\$600**: "Reduction of transplant shock using antitranspirants" 1/87

Aquatrols Corp., **\$18,500**: "Use of Folicote, a wax emulsion antitranspirant for enhancing water balance and increasing plant survival of vegetable crop transplants" 8/86

NSF, Metabolic Biology Program, **\$93,000**: "Identification of the relationship *in vivo* between chloroplast stromal pH, drought stress and photosynthetic potential" 1/85

International Potash and Phosphate Institute, **\$10,000**: "Superoptimal K⁺ enhancement of photosynthesis under water stress" 1/85

Invited Lectures at National/International Symposia:

Sands L, Berkowitz GA 2022 Molecular analysis of regulatory mechanisms controlling cannabinoid synthesis in Cannabis. CT CANNAXPO. 5/2022

Haiden S, Berkowitz GA 2022 Cannabis research at the Univ. Conn. Stockton State Univ. Cannabis Curriculum convening online conference.

Berkowitz GA, Haiden S, DeBacco M 2021 Cannabis teaching and research at the Univ. Conn. Stockton State Univ. Cannabis Curriculum convening online conference.

Ma Y, Berkowitz GA 2021 Rate limitations to cannabinoid production in cannabis. Analytical Cannabis Extraction, Science and Testing. <https://www.analyticalcannabis.com>.

Apicella P, Berkowitz GA. 2020. The Plant Science of Cannabis sativa”, Tower Hill Botanical Garden, Boylston, MA

Haiden S, Berkowitz GA 2020 Molecular signals that regulate trichome formation in cannabis. The Science of Cannabis Cultivation Online Symposium. <https://www.analyticalcannabis.com>.

Apicella P, Ma Y, Picard R, Barroli S, Ferresse R, Berkowitz GA 2020 Looking under the hood of the cannabis plant’: Molecular studies of cannabinoid biosynthetic genes, transcription factors regulating trichome development and pathway gene expression, effects of plant hormones on end-product production in female cannabis flowers. 6th Annual Emerald Conference February 26-29, San Diego, California

Berkowitz GA, Apicella P, Ma Y 2020 The science of cannabis. Yale School of Management symposium on the Business of Legal Cannabis.

Apicella P, Berkowitz GA 2020 Cannabis on Campus: Not what you think! CT Horticultural Society Annual Mtg.

Berkowitz GA 2020 Looking under the hood of the cannabis plant. Univ VT 2020 Industrial Hemp Conf. Burlington VT

Ma G, Ma Y, Berkowitz GA 2020 Identification of New Genes in Cyclic Adenosine Monophosphate (cAMP) Signaling Pathway by Using cAMP Sponge Strategy. Amer Soc Plant Biol Natl Mtg Abstract ID: 854039

Haiden S, Apicella P, Ma Y, Munteanu D, Berkowitz GA 2020 Exogenous Application of Salicylic Acid May Elicit Expression of Key Genes in the Cannabinoid Biosynthesis Pathway. Amer Soc Plant Biol Natl Mtg

Apicella P. and Berkowitz GA. 2020. The Plant Science of Cannabis sativa. Connecticut Horticultural Society. West Hartford, Connecticut.

Apicella P. and Berkowitz GA. 2019 The Plant Science of Cannabis sativa. Middlesex Community College, Middletown, CT.

Apicella P. and Berkowitz G. 2019 The Plant Science of Cannabis sativa”, Metropolitan Horticultural Society, NY, NY.

Apicella P., Berkowitz G. “Cannabis and Hemp Academia Town Hall”, Cannabis World Congress & Business Expo. New York, New York. June 2019

Apicella P, Laucius G, Jepsen S, Ma Y, Berkowitz GA 2019 CBDA synthase expression is correlated with cannabidiol (CBD) production in Cannabis sativa (hemp) flowers. Amer. Soc. Plant Biol. Natl. Mtg.

Apicella P, Berkowitz GA. 2019 Cannabis research at UConn. NY Horticultural Society Forum on Cannabis.

Berkowitz GA, Apicella P 2019 Optimizing cannabinoid production. Eastern US Hemp Conf. Albany NY June 2-4.

Berkowitz GA, Ma Y 2017 Development of a live-cell real-time luciferase-based biosensor to track cytosolic cAMP elevations in microdomain signalsomes that link ligand perception by cell receptors to cytosolic Ca²⁺ signal transduction pathways. Plant Calcium Signaling Symposium (Norwich UK)

Ma Y, Berkowitz GA 2017 A putative Arabidopsis cyclic nucleotide phosphodiesterase mutant is involved in plant innate immunity. Plant Calcium Signaling Symposium (Norwich UK)

Ma Y, Berkowitz GA 2016 Using GCamp as a fusion protein to detect ligand induced cytosolic Ca²⁺ generation. International. Plant Memb. Biol. Workshop. Univ. MD.

Li, X, Chou H, Ma Y, Garrido K, Berkowitz GA 2016 Development and testing of a new biosensor for real time *in vivo* measurement of the cytosolic secondary messenger cAMP in plants. International Plant Memb. Biol. Workshop. Univ. MD.

- Ma Y, Berkowitz GA 2015 Visualization of real-time cytosolic Ca²⁺ elevation using a novel optogenetic Ca²⁺ sensor. Amer. Soc. Plant Biol. Natl. Mtg. Minisymposium. 500-006-Z
- Berkowitz GA 2014 Molecular steps in Ca²⁺ signaling pathways downstream from perception of peptides and hormones by cell membrane receptors. Plant Calcium Signaling Symposium. (Muenster, Germany)
- Zhao Y, Ma Y, Chou H, Berkowitz GA 2013 Membrane receptors and Ca²⁺ signaling: extra-, and intracellular Ca²⁺ conductance pathways and signaling evoked by PEPR, FLS2, and CLV1 receptors. Amer. Soc. Plant Biol. Natl. Mtg. Minisymposium.
- Berkowitz GA 2013 The brassinosteroid, clavata 3, and endogenous immune peptide receptors activate signaling cascades through cytosolic calcium elevation. Int. Plant Memb. Biol. Workshop (Kurashiki, Japan).
- Chou H, Zhu Y, Berkowitz GA 2012 Elucidation of a signaling pathway mediating CLAVATA 3 peptide and CLAVATA 1 receptor control of stem cell fate in meristematic tissue. Amer. Soc. Plant Biol. Natl. Mtg. Minisymposium
- Ma Y, Berkowitz GA 2012 Differences between initial molecular steps of DAMP and PAMP receptor mediated immune cascades: studies of calcium signaling by PEPR1 and FLS2. Amer. Soc. Plant Biol. Natl. Mtg. Minisymposium
- Ma Y, Walker RK, Zhao Y, Berkowitz GA 2011 Delineating steps in an immune signaling pathway: AtPep receptors, cGMP and calcium signaling. Amer. Soc. Plant Biol. Natl. Mtg. Minisymposium M0703
- Zhao, Y, Zhi Q, Wheeler J, Kwezi L, Irving HR, Gehring C, Berkowitz GA 2010 Teaching an old hormone new tricks: Brassinosteroid receptor-mediated Ca²⁺ signaling. Amer. Soc. Plant Biol. Natl. Mtg. Minisymposium M1302
- Ma E, Smigel A, Walker RK, Moeder W, Qi A, Yoshioka K, Berkowitz GA 2009 Leaf senescence signaling: Ca²⁺ accumulation mediated by Arabidopsis cyclic nucleotide gated channel2 acts through nitric oxide to repress senescence programming. Amer. Soc. Plant Biol. Natl. Mtg. Minisymposium M3002
- Ma W, Ali R, Smigel A, Lemtiri-Chlieh F, Verma R, Gehring CA, Pearce G, Ryan CA, Berkowitz GA 2008 Cyclic nucleotides act as an early signal upstream from Ca²⁺ in plant innate immunity. Amer. Soc. Plant Bio. Natl. Mtg. Minisymposium M0403
- Ali R, Tsaltas D, Lemtiri-Chlieh F, Leng Q, von Bodman S, Berkowitz, GA 2006 Death don't have no mercy, and neither does calcium: A cyclic nucleotide gated Ca channel is upstream from nitric Joint Meeting of the Amer. Phytopath. Soc., Canadian Phytopath. Soc. & Mycol. Soc. Amer. Molecular Signaling in Phyllosphere Interactions Symposium
- Ali R, Tsaltas D, Lemtiri-Chlieh F, Leng Q, von Bodman S, Berkowitz, GA 2006 Plant cell Ca²⁺ currents and downstream nitric oxide generation: unraveling a plant innate immunity signaling cascade. Amer. Soc. Plant Bio. Natl. Mtg. Minisymposium
- Yoshioka K, Moeder W, Kang H-G, Kachroo P, Masmoudi K, Berkowitz GA, Klessig DF 2006 The chimeric cyclic nucleotide-gated ion channel AtCNGC11/12 activates multiple pathogen resistance responses. Amer. Soc. Plant Bio. Natl. Mtg. Minisymposium
- Berkowitz GA 2004 Cell signaling and calcium-conducting channels. Water and salt stress in plants Gordon Research Conference. Hong Kong.
- Berkowitz GA, Loder L, Ali R, Lemtiri-Chlieh F, Salt, DE 2004 Plant CNGCs: functional characterization of plant cation channels using native membranes, mutant plants, and heterologous expression systems. Amer. Soc. Plant Biol. Natl. Mtg. Minisymposium
- Zielinski R, Berkowitz Gerald A, Lemtiri-Chlieh F, Mercier R, Ditzler M, Harish A 2003 CNGC2-CaM interaction, a paradigm for Ca²⁺ and cNMP-modulated signaling in plants. Amer. Soc. Plant Biol. Natl. Mtg. Minisymposium
- Berkowitz GA 2002 Molecular architecture related to K⁺ and Na⁺ permeation/exclusion through cloned plant ion channels; studies using heterologous expression systems Water and salt stress in plants Gordon Research Conference. Oxford, UK
- Berkowitz GA 2001 Molecular characterization of plant K channels. International symposium of importance of potassium in nutrient management for sustainable crop production in India
- Leng Q, Mercier R, Berkowitz GA 1999 First functional characterization of a plant cyclic nucleotide-gated cation channel by oocyte expression and voltage clamp analysis. Amer. Soc. Plant Physiol. Natl. Mtg. Minisymposium

- Berkowitz GA 1997 Molecular analysis of plant K channels. Amer. Soc. Plant Physiol. Natl. Mtg. President's Symposium
- Berkowitz GA 1996 Molecular characterization of plant potassium channels. Amer. Soc. Agron. Natl. Mtg.
- Berkowitz GA 1987 Magnesium effects on chloroplast metabolism and its protective effects in drought. Gordon Research Conf. on Magnesium in Biochemical Processes and Medicine
- Berkowitz GA, M Gibbs 1984 Water deficit effects on nonstomatal mediated photosynthesis. In: C Sybesma, ed., Advances in Agricultural Biotechnology (Advances in Photosynthesis Research Vol. 4), M Nijhoff/W Junk Pub, Brussels, pp. 367-373
- Berkowitz GA, M Gibbs 1982 *In vitro* osmotic stress and chloroplast metabolism. Gordon Research Conf. on CO₂ Fixation by Green Plants

Invited Presentation at Conferences:

- Berkowitz GA, Apicella P, Ma Y 2020 CT 2020 Hemp Conference: Looking Under the Hood of the Cannabis Plant: Molecular Studies of How to Increase End-Product (CBD and THC) Cannabinoid Synthesis
- Berkowitz GA, P Nitzsche 1987 Use of soil amendments to reduce transplant shock in vegetable seedlings. *Eos* 68:1296 (presented to the 1987 American Geophysical Union National Meeting)
- Berkowitz GA 1988 Advanced research: one perspective bearing on drought tolerance. Workshop on Developed Country Undertakings in International Horticulture. Rutgers Univ.
- Berkowitz GA, R Nathan 1990 Na currents in cultured primary pacemaker cells of the rabbit heart sinoatrial node. American Heart Society Natl. Mtg.
- Feng M, GA Berkowitz 1993 Design and testing of a generic K⁺ channel antibody. Macromolecular Recognition Symposium. Center for Advanced Biotechnology and Medicine, Univ. of Medicine and Dentistry of New Jersey.

Abstracts:

- Haiden S, Palencia-Prieto M, Berkowitz GA 2022 A new approach to increasing THC levels in controlled environment cannabis production. Amer Soc Plant Biol Natl Mtg
- Ma G, Zelman AK, Apicella PV, Berkowitz GA 2022 Genome-wide identification and expression analysis of homeodomain leucine zipper subfamily IV (HD-ZIP IV) gene family in Cannabis sativa L Amer Soc Plant Biol Natl Mtg
- Zelman C, Ma Y, Huffaker A, Berkowitz GA 2022 Pep peptides activate pathogen immune defense responses in tomato plants. Amer Soc Plant Biol Natl Mtg
- Zaki A, Sand LB, Palencia-Prieto M, Berkowitz GA 2022 Evaluation of a commercial biostimulant for enhancement of cannabis growth. Amer Soc Plant Biol Natl Mtg
- Sands LB, Ma Y, Berkowitz GA 2022 Analysis of hormone regulation in the production of Cannabigerolic Acid, CBGA, the precursor in the cannabinoid biosynthetic pathway in Cannabis sativa. Amer Soc Plant Biol Natl Mtg
- Haiden S, Apicella P, Ma Y, Munteanu D, Berkowitz GA 2020 TF.X, a transcription factor in C. may control trichome epidermal cell fate in Cannabis sativa. Amer Soc Plant Biol Natl Mtg
- Apicella P, Laucius G, Jepsen S, Ma Y, Berkowitz GA 2019 CBDA synthase expression is correlated with cannabidiol (CBD) production in Cannabis sativa (hemp) flowers.
- McKee E III, Apicella P, Laucius G, Berkowitz GA 2019 The effect of cultured lactic acid bacteria (LAB) on Cannabis sativa terpene content. Amer. Soc. Plant Biol. Natl. Mtg.
- Laucius G, Apicella P, Ma Y, Berkowitz GA 2019 High throughput method for the analysis of terpenes in Cannabis sativa. Amer. Soc. Plant Biol. Natl. Mtg.
- Ma G, Ma Y, Zielinski RE, Berkowitz GA 2019 A GCaMP6s Ca²⁺ indicator shows brassinosteroid and forskolin (activator of cAMP synthesis) may signal through CNGCs. Amer. Soc. Plant Biol. Natl. Mtg.
- Apicella P, Laucius G, Jepsen S, Ma Y, Berkowitz GA 2019 CBDA synthase expression is correlated with cannabidiol (CBD) production in Cannabis sativa (hemp) flowers. Amer. Soc. Plant Biol. Natl. Mtg.
- Reynolds J, Cheek T, Estrin P, Apicella P, Ma Y, Blake M, McGehee C, Berkowitz GA 2018 Exposure of seeds to pathogen associated molecular pattern (PAMP) molecules activates plant immune responses: a biological approach for control of fungal pathogens on Cannabis sativa that also enhances germination and growth. Amer. Soc. Plant Biol. Natl. Mtg. 200-058.
- Williams D, Roth S, Reynolds J, Berkowitz GA 2018 Field Pharming Cannabis: Developing commercial field

- production regimes for high Cannabidiol (CBD)-containing hemp, and high-throughput industrial-scale cannabinoid and terpene extraction technologies on harvested female flowers. Amer Soc Plant Biol Natl Mtg. 200-052.
- Blake M, Apicella P, Mahoney J, Estrin P, Ma Y, Berkowitz GA 2018 Development of a tissue culture platform for the propagation, genetic transformation, and regeneration of *Cannabis sativa*. Amer. Soc. Plant Biol. Natl. Mtg. 200-049.
- Reynolds J, Blake M, Cheek T, McKee E, Gentino M, Lyga B, Durocher S, Berkowitz GA 2018 Cannabis horticulture: Evaluating some aspects of commercial controlled environment production systems. Amer. Soc. Plant Biol. Natl. Mtg. 200-059.
- Ma Y, Estrin P, Trouern-Trend A, Wan M, Surala S, Laucius G, Berkowitz GA 2018 Application of ethylene to *Cannabis sativa* plants increases female flower size, flower number, cannabidiol synthase a expression, and levels of cannabidiol. Amer Soc Plant Biol Natl Mtg 200-050.
- Ma Y, Berkowitz GA 2018 Brassinosteroid induced, Ca²⁺ and cyclic nucleotide associated signaling in *Arabidopsis* involves G proteins. Amer Soc Plant Biol Natl Mtg. 600-010.
- Ma Y, Berkowitz GA 2015 Visualization of real-time cytosolic Ca²⁺ elevation using a novel optogenetic Ca²⁺ sensor. Amer. Soc. Plant Biol. Natl. Mtg. Minisymposium. 500-006-Z
- Chou H, Berkowitz GA 2015 Development and testing of a new biosensor for real-time in vivo measurement of the cytosolic secondary messenger cAMP in plants. Amer. Soc. Plant Biol. Natl. Mtg. Minisymposium. 500-008-Y
- Zelman A, Berkowitz GA 2014 SiPep1 peptide evokes immune responses and reduces pathogen growth in tomato. ASPB Natl. Mtg. P29009-C
- Hsou H, Berkowitz GA 2014 Linking Ca²⁺ to the brassinosteroid signal transduction cascade: molecular steps that modulate BR responsive gene expression ASPB Natl. Mtg. P38026-B
- Ma Y, Berkowitz GA 2014 Examination of the three putative functional residues in the putative guanylyl cyclase domain in PEPR1 and BRI1 ASPB Natl. Mtg. P38027-C
- Zhao Y, Ma Y, Chou H, Berkowitz GA 2013 Membrane receptors and Ca²⁺ signaling: extra-, and intracellular Ca²⁺ conductance pathways and signaling evoked by PEPR, FLS2, and CLV1 receptors. . ASPB Natl. Mtg. P24024.
- Zhao Y, Berkowitz GA 2013 Inositol polyphosphates, nitric oxide, G proteins, and intracellular Ca²⁺ release are involved in flagellin dependent immune responses. ASPB Natl. Mtg. P24020
- Zelman AK, Perumalla A, Huffaker AH, Berkowitz GA 2013 SiPep peptide elicits pathogen defense responses in tomato. ASPB Natl. Mtg. P21026
- Chou H, Berkowitz GA 2013 Elucidation of a signaling pathway mediating CLAVATA 3 peptide and CLAVATA 1 receptor control of stem cell fate in meristematic tissue. ASPB Natl. Mtg. P10026
- Ma Y, Berkowitz GA 2013 *Arabidopsis* CNGC2 and CNGC4 form heteromeric channels involved in Plant Elicitor Peptide (Pep) induced Ca²⁺-dependent pathogen defense responses. ASPB Natl. Mtg. P24017
- Zelman AK, Dawe A, Gehring C, Berkowitz GA 2012 Identifying orthologs to *Arabidopsis* plant cyclic nucleotide gated channels across the plant kingdom. ASPB Natl. Mtg. P17027
- Chou H, Zhu Y, Berkowitz GA 2012 Elucidation of a signaling pathway mediating CLAVATA 3 peptide And CLAVATA 1 receptor control of stem cell fate in meristematic tissue ASPB Natl. Mtg. P27014
- Zelman AK, Huffaker AH, Berkowitz GA 2012 A newly identified tomato peptide induces cytosolic calcium and may correspond to pathogen defense-related endogenous peptides in *Arabidopsis*. ASPB Natl. Mtg. P27017
- Yi Ma Y, Berkowitz GA 2012 Differences between initial molecular steps of DAMP and PAMP receptor mediated immune cascades: Studies of calcium signaling by PEPR1 and FLS2. ASPB Natl. Mtg. P27020
- Yichen Zhao Y, Berkowitz GA 2012 Brassinosteroid hormone action involves Ca²⁺ and cGMP: the BRI1 receptor has guanylyl cyclase activity that activates a Ca²⁺ channel. ASPB Natl. Mtg. P27015
- Ma Y, Berkowitz GA 2011 Plant innate immunity is regulated by CDPKs and NO in the AtPep3 activated calcium signaling cascade. ASPB Nat. Mtg. P20012
- Zhu Y, Chou H, Berkowitz GA 2011 A model for translation of cell-to-cell communication into signals that regulate stem cell fate: CLAVATA3 signals through calcium. ASPB Nat. Mtg. P04014

- Zhao, Y, Zhi Q, Wheeler J, Kwezi L, Irving HR, Gehring C, Berkowitz GA 2010 Teaching an old hormone new tricks: Brassinosteroid receptor-mediated Ca²⁺ signaling. ASPB Natl. Mtg. P10007
- Walker RK, Zhao Y, Ma Y, Berkowitz GA 2010 Overlapping involvement of the receptors FLS2 and PEPR1 in immune defense signaling. ASPB Nat. Mtg. P13037
- Ma W, Ali R, Smigel, A, Walker R, Lemtiri-Chlieh F, Verma R, Gehring CA Berkowitz GA 2008 Mechanisms involved in PAMP receptor pathogen perception leading to plant innate immunity; involvement of cyclic nucleotide and Ca²⁺. Plant Innate Immunity. Keystone Symposium. Keystone, CO, USA.
- Ma, Wei M. Smigel A, Walker RK Moeder W, Zhi Q, Yoshioka, K, Berkowitz G 2009 Leaf senescence signaling: Ca²⁺ accumulation mediated by Arabidopsis cyclic nucleotide gated channel2 acts through nitric oxide to repress senescence programming. ASPB Natl. Mtg. P55005
- Zhi Q, Verma R, Gehring, Chris C, Yamaguchi Y, Ryan, CA Berkowitz, GA 2009 Identification of nucleotidyl cyclase activity of a unique membrane receptor and its role upstream from Ca channel activation in pathogen response intracellular signaling. ASPB Natl. Mtg. P35007
- Walker RK, Zhi Q, Braam J, Berkowitz, GA 2009 Arabidopsis calmodulin like protein 24 (CML24) is required for lipopolysaccharide and ABA-induced stomatal closure and nitric oxide/reactive oxygen species production in guard cells. ASPB Natl. Mtg. P 55011
- Ma W, Smigel A, Walker RK, Moeder W, Qi A, Yoshioka K, Berkowitz GA 2009 Leaf senescence signaling: Ca²⁺ accumulation mediated by Arabidopsis cyclic nucleotide gated channel2 acts through nitric oxide to repress senescence programming. ASPB Natl. Mtg. M3002
- Walker RA, Berkowitz GA 2008 Differences in G-protein and Ca-channel involvement in ABA and pathogen signaling to nitric oxide and hydrogen peroxide in the guard cell. ASPB Natl Mtg P15012
- Ma W, Ali R, Smigel A, Lemtiri-Chlieh F, Verma R, Gehring CA, Berkowitz GA 2008 Cyclic nucleotides act as an early signal upstream from Ca²⁺ in plant innate immunity. APSB Natl Mtg P15011
- Ma W, Smigel A, Tsai YC, Braam J Berkowitz GA 2008 Innate immunity signaling: cytosolic Ca²⁺ elevation as an early signal is linked to downstream nitric oxide generation through the action of calmodulin or a calmodulin-like protein. ASPB Natl Mtg P15013
- Ma W, Ali R, Smigel, A, Walker R, Lemtiri-Chlieh F, Verma R, Gehring CA Berkowitz GA 2008 Mechanisms involved in PAMP receptor pathogen perception leading to plant innate immunity; involvement of cyclic nucleotide and Ca²⁺. Plant Innate Immunity. Keystone Symposium. Keystone, CO, USA.
- Ma W, Smigel A, Tsai Y-C, Braam J, Berkowitz GA 2007 CNGC-mediated Ca conductance, cytosolic Ca/CaM rise and resulting activation of nitric oxide generation are critical steps in plant innate Immunity. APSB Natl Mtg P15022
- Walker RK, Ma W, Leng Q, Berkowitz GA 2007 Pathogen perception signaling cascades in the guard cell: involvement of Ca-conducting CNGC channels, calmodulin, nitric oxide, and hydrogen peroxide. APSB Natl Mtg P15056
- Ma W, Ali R, Lemtiri-Chlieh F, Smigel A, Berkowitz GA 2007 cAMP acts as an early signal upstream from Ca²⁺ in plant pathogen perception signaling cascades. APSB Natl Mtg P15049
- Ali R, Tsaltas D, Lemtiri-Chlieh F, Leng Q, von Bodman S, Berkowitz, GA 2006 Plant cell Ca²⁺ currents and downstream nitric oxide generation: unraveling a plant innate immunity signaling cascade. Annu Mtg APSB #11005
- Ma W, Asmatulu E, Ali R, Loder L, Berkowitz GA 2006 Effect of loss-of-function mutation in the cyclic nucleotide gated channel AtCNGC1 on Na⁺-related Arabidopsis plant phenotypes. Annu Mtg APSB #11023.
- Ali R, Nguyen T, Solomon-Badhai M, Berkowitz GA 2006 Heterologous expression of plant cyclic nucleotide gated channels in cation transport yeast mutants reveals varying selectivity of the plant channels for K, Na, and Ca conductance. Annu Mtg APSB #11020.
- Yoshioka K, Moeder W, Kang H-G, Kachroo P Masmoudi K, Berkowitz, GA, Klessig DF 2006 The chimeric cyclic nucleotide-gated ion channel AtCNGC11/12 activates multiple pathogen resistance responses. Annu Mtg APSB #11023.
- Swanson J, Ali R, Berkowitz GA 2005 Information flow from gene to whole organism phenotype: bringing an understanding of protein structure/function to the high school classroom. Annu Mtg Amer Soc Plant Biol #1155 ([Education section poster](#))
- Ma W, Ali R, Berkowitz GA 2005 *AtCNGC1*: A cyclic nucleotide gated channel that conducts calcium and contributes to root gravitropism. Annu Mtg APSB #192.

- Ali R, Tsaltas D, von Bodman S, Berkowitz GA 2005 Ca conductance through cyclic nucleotide gated channels may affect nitric oxide signaling in the plant hypersensitive response to pathogens. Annu Mtg APSB #198.
- Berkowitz GA, Loder L, Salt DE 2004 Characterization of ion transport-related phenotypes of Arabidopsis plants with mutations in genes encoding cyclic nucleotide gated nonselective cation channels. Annu Mtg APSB #164
- Berkowitz GA, Loder L, Ali R, Lemtiri-Chlieh F, Salt DE 2004 Plant CNGCs: functional characterization of plant cation channels using native membranes, mutant plants, and heterologous expression systems. Annu Mtg APSB #45005
- Ali R, Berkowitz GA 2004 Expression of Arabidopsis cyclic nucleotide gated nonselective cation channels (CNGCs) in yeast: Problems and prospective. Annu Mtg APSB #167
- Lemtiri-Chllieh F, Ali R, Berkowitz, GA 2004 Use of yeast as a heterologous expression system for electrophysiological analysis of plant CNGC channels. Annu Mtg APSB #178
- Rabinowitz NM, Mercier RW, Gaxiola RA, Berkowitz GA 2003 Functional characterization of inwardly K-conducting plant cyclic nucleotide gated channels using a *trk1*, *trk2* yeast mutant. Annu Mtg Amer Soc Plant Biol #1285
- Mercier RW, Makriyannis A, Li C, Berkowitz GA 2003 electrophysiological analysis of anandamide/capsaicin hybrid analogs in *Xenopus* oocytes expressing VR1: discovering therapeutic agents in pain prevention. Annu Mtg APSB #1295
- Lemtiri-Chlieh F, Berkowitz GA 2003 Evaluating the role of cyclic nucleotides in modulation of native plant cell inward Ca and K currents. Annu Mtg APSB #1307
- Gaxiola RA, Sunghun P, Pittman J, Berkowitz GA, Li Jisheng, Morris J, Undurraga S, Yang Haibing, Hirschi KD 2003 Ectopic overexpression in tomato of the Arabidopsis AVP1 gene results in drought resistance. Annu Mtg APSB #231
- Mercier RW, Kastal E, Sutyak KE, MacLean I, Berkowitz GA 2003 Undergraduate student involvement in bioinformatics: genetic analysis of T-DNA insertional mutant plants as an education tool. Annu Mtg APSB #15 ([Education section poster](#))
- Brini F, Masmoudi K, Gaxiola RA, Berkowitz GA 2003 Cloning and characterization of wheat vacuolar cation/proton antiporter and pyrophosphatase proton pump. Annu Mtg APSB #1283
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