

BIOGRAPHICAL SKETCH

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|--|---------------------------|---------------------------------------|
| NAME Chen, Qiang (Shawn), Ph.D. | | POSITION TITLE Associate Professor |
| EDUCATION (<i>Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.</i>) | | |
| INSTITUTION AND LOCATION | DEGREE (if applicable) | FIELD OF STUDY |
| Zhongshan University | B. S. | Plant Physiology & Biology |
| University of Arizona | Ph.D. | Biochemistry |
| University of Minnesota | Post-Doc | Molecular Biology & Genetics |

POSITIONS

2003 Protein Expression Lead, Protein Technologies, Monsanto Company, Madison, Wisconsin
 2004 - 2005 Director, Protein Chemistry, Middleton Branch, Cardinal Health, Madison, Wisconsin
 2006 -2011 Assistant Professor, The Biodesign Institute and Department of Applied Biological Sciences, Arizona State University, Tempe and Mesa, Arizona
 2011 - 2014 Associate Professor with tenure, The Biodesign Institute and College of Technology and Innovation, Arizona State University, Tempe and Mesa, Arizona
 2014 - Associate Professor with tenure, School of Life Sciences and The Biodesign Institute, Arizona State University, Tempe, Arizona

HONORS AND AWARDS:

Faculty Excellence Award: Excellence in Scholarly and Creative Activities, College of Technology and Innovation, ASU

College Marshal for College of Technology and Innovation of ASU, Fall 2010 Undergraduate Commencement

Research Award (Excellence in Protein Chemistry, Process Development), Cardinal Health

Postdoctoral Fellowship, National Institutes of Health (NIH)

Postdoctoral Fellowship, PMGI Foundation, State of Minnesota

China-US Biochemistry Program (CUSBEA) Fellowship, CUSBEA- Ray Wu Foundation.

RELATED INDUSTRY EXPERIENCE

Dr. Chen has more than 10 years of experience in monoclonal antibody research in both biotechnology and pharmaceutical industry. He led a large division dedicated to optimize the expression, assembly and production of MABs and other therapeutic proteins in transgenic plants. He successfully directed several multi-institution collaborative projects for therapeutic MAb product development. Prior to joining ASU, he was the director of Division of Protein Chemistry at Cardinal Health, directing research on MAb-fusion protein design and optimization in mammalian cell cultures. He was also in charge of operations for manufacturing MAB and MAb fusion proteins for clinical trials under cGMP regulations.

SELECTED PEER-REVIEWED PUBLICATIONS:

1. He J, Lai H, Engle M, Gorlatov S, Gruber C, Steinkellner H, Diamond M, **Chen Q***. Generation and analysis of novel plant-derived antibody-based therapeutic molecules against West Nile virus. PLOS ONE 2014; 9(3): e93541. PMID: PMC3968140.

2. Lai H, He J, Hurtado J, Stahnke J, Fuchs A, Melhop E, Gorlatov S, Loos A, Diamond M, **Chen Q***. Structural and functional characterization of an anti-West Nile virus monoclonal antibody and its single-chain variant produced in glycoengineered plants. Plant Biotech J 2014; In press.
3. He J, Peng L, Lai H, Hurtado J, Stahnke J, **Chen Q***. A plant-produced antigen elicits potent immune responses against West Nile virus in mice. Biomed Res Int. 2014;2014:952865. PMID: PMC3996298.
4. **Chen Q***, Santi L, Zhang C. Plant-made biologics. Biomed Res Int. 2014;2014:418064. PMID: PMC.
5. **Chen Q***, Lai H, Plant-derived Virus-like Particles as Vaccines. Hum Vaccin Immunother, 2013; 9(1) 26-49. PMID: PMC3667944.
6. K Leuzinger, M Dent, J Hurtado, J Stahnke, Lai H, X. Zhou, **Chen Q***. Efficient agroinfiltration of plants for high-level transient expression of recombinant proteins. J. Vis. Exp., 2013; 77: e50521, PMID: PMC3846102.
7. **Chen Q***, Lai H, J Hurtado, J Stahnke, K. Leuzinger, M. Dent. Agroinfiltration as an effective and scalable strategy of gene delivery for production of pharmaceutical proteins in plants. Adv Tech Biol Med, (2013), 1:103. doi: 10.4172/atbm.1000103. PMID:
8. Lai H, He J, Engle M, Diamond M, **Chen Q***. Robust production of virus-like particles and monoclonal antibodies with geminiviral replicon vectors in lettuce. Plant Biotech. J 2012; 10(1): 95-104. PMID: PMC3232331.
9. He J, Lai H, Brock C, **Chen Q***. A novel system for rapid and cost-effective production of detection and diagnostic reagents of West Nile virus in plants. J Biomed Biotechnol 2012; doi:10.1155/2012/106783. PMID: PMC3236498.
10. Lai H, **Chen, Q***. Bioprocessing of plant-derived virus-like particles of Norwalk virus capsid protein under current Good Manufacture Practice regulations. Plant Cell Reports 2012; 31(3) 573-584. PMID: PMC3278561.
11. Mo Q, Mai R, Yang Z, Chen M, Yang T, Lai H, Yang P, **Chen Q**, Zhou X. A hydroponic cultivation system for rapid high-yield transient protein expression in Nicotiana plants under laboratory conditions. J South Med Univ, 2012; 32:772-777. PMID: 22699052.
12. Phoolcharoen W, Dye J, Kilbourne J, Piensook K, Pratt W, Arntzen C, **Chen, Q**, Mason H, Kralovetz M. A non-replicating subunit vaccine protects mice against lethal Ebola virus challenge. PNAS 2011; 108 (51): 20695-20700. PMID: PMC3251076.
13. Phoolcharoen W, Bhoo S, Lai H, Ma J, Arntzen C, **Chen Q***, Mason H*. Expression of an immunogenic Ebola immune complex in Nicotiana benthamiana. Plant Biotech J. 2011; 9(7): 807-816. PMID: PMC4022790.
14. **Chen Q**, He J, Phoolcharoen W, Mason H. Geminiviral Vectors Based on Bean Yellow Dwarf Virus for Production of Vaccine Antigens and Monoclonal Antibodies in Plants. Human Vaccines 2011; 7(3):331-338. PMID: PMC3166492.
15. **Chen Q***. Turning a new leaf. European Biopharm Rev. 2011; 2:64-68
16. Lai H, Engle M, Fuchs A, Keller T, Johnson S, Gorlatov S, Diamond M, **Chen Q***. A monoclonal antibody produced in plants efficiently treats West Nile virus infection in mice. PNAS 2010; 107: 2419-2424. PMID: PMC2823901.
17. Huang Z, Phoolcharoen W, Lai H, Piensook K, Cardineau G, Zeitlin L, Whaley K, Arntzen C, Mason H, **Chen Q***. High-level rapid production of full-size monoclonal antibodies in plants by a single-vector DNA replicon system. Biotech and Bioeng 2010; 106: 9-17. PMID: PMC2905544
18. Kralovetz M, Mason H, **Chen Q**. Norwalk Virus-like Particles as Vaccines. Expert Review of Vaccines 2010; 9:299-307. PMID: PMC2862602.
19. Huang Z, **Chen Q**, Hjelm B, Arntzen C, Mason H. A DNA Replicon System for Rapid High-level Production of Virus-like Particles in Plants. Biotech and Bioeng 2009; 103: 706-714. PMID: PMC2704498.
20. Slater S, et al. **Chen Q**, Phoolcharoen W, et al. Zhu H, Wood D. Genome Sequences of Three Agrobacterium Biovars Elucidate the Evolution of Multichromosome Genomes. J. Bact. 2009; 191: 2501-1511. PMID: PMC2668409.
21. **Chen, Q***. Expression and Purification of Pharmaceutical Proteins from Plants. Biol. Eng. 2008; 1: 291-321.
22. Lico C, **Chen Q**, Santi L. Viral Vectors for Production of Recombinant Proteins in Plants. J Cell. Physiol. 2008; 216:366-377. PMID: 18330886.

23. Santi L, Batchelor L, Huang Z, Hjelm B, Arntzen C, **Chen Q**, and Mason H. Orally Immunogenic Norwalk Virus-like Particles Were Efficiently Produced by a Plant Viral Expression. Vaccine, 2008; 26: 1846-1854. PMID: PMC2744496.
24. **Chen Q**, Morris G, Lai H. cGMP processing of a plant-produced human vaccine candidate for sexually transmitted infections. ASABE 2009; 095608:1-6.
25. Arntzen C, Mason H, **Chen Q**, Khalsa G. Designing and Delivering Plant-based Vaccines for the Developing World. P. Plant Pathol. 2007; 17:55-70.
26. Buswell, S, Medina-Bolivar, F, **Chen, Q**, Van Cott, K, and Zhang, C. Expression of Porcine Prorelaxin in Transgenic Tobacco. Ann. N.Y. Acad. Sci. 2005; 1041:77–81. PMID: 15956689.
27. **Chen Q**, Silflow C. Isolation and Characterization of Glutamine Synthetase Genes in *Chlamydomonas reinhardtii*. Plant Physiol. 1996; 112:987-996. PMID: PMC158025.
28. **Chen Q**, Osteryong K, Vierling E. A 21 kDa Chloroplast Heat Shock Protein Assembles into High Molecular Weight Complex In Vivo and In Organelle. J. Biol. Chem. 1994; 269:13216-13223. PubMed PMID: 8175751.
29. **Chen Q**, Vierling E. Analysis of Conserved Domains Identifies a Unique Structural Feature of a Chloroplast Heat Shock Protein. Mol. Gen. Genetics. 1991; 226:425-431. PMID: 1886617.
30. **Chen Q**, Lauzon LM, DeRocher A, Vierling E. Accumulation, Stability and Localization of a Major Chloroplast Heat Shock Protein. J. Cell Biol. 1990; 110:1873-1883. PMID: PMC2116130.
31. Vierling E, Harris LM, **Chen Q**. The Major Low Molecular Weight Heat Shock Protein in Chloroplasts Shows Antigenic Conservation among Diverse Higher Plant Species. Mol. and Cell Biol. 1989; 9:461-468. PMID: PMC362621.

Book chapters from ASU

32. **Chen Q***, Dent M, Hurtado J, Stahnke J, McNulty A, Leuzinger K, Lai H. "Large Scale Transient Expression by Agroinfiltration in Lettuce". In: *Methods in Molecular Biology - Recombinant Proteins from Plants*, ed. by Menassa R. S, Springer New York, 2014.
33. **Chen Q***, Lai H. "Plant-derived monoclonal antibodies as human biologics for infectious disease and cancer". In: *Plant-Derived Pharmaceuticals for Developing Countries*, ed. by K. Hefferon, CABI Press, Oxfordshire. 2014, In press.
34. **Chen Q***. "Virus-like Particle Vaccines for Norovirus Gastroenteritis". In: *Molecular Vaccines - from Prophylaxis to Therapy*, ed. by M. Giese, Springer Vienna/ New York. 2013, 8:152-181. DOI 10.1007/978-3-7091-1419-3_8.
35. **Chen Q***. "Genetically Engineered Horticultural Crops for Pharmaceutical Production". In: *Transgenic Horticultural Crops: Challenges, and Opportunities - Essays by Experts*, ed. by B. Mou, R. Scorza, CRC Press, Boca Raton. 2011, 4: 85-126
36. **Chen Q**, Tacket C, Mason H, Mor T, Cardineau G, Arntzen C. "Subunit Vaccines Produced Using Plant Biotechnology". In: *New Generation Vaccines; Fourth Edition*, ed. by M. Levine, Informa Healthcare, New York. 2009; 30:306-315.

PATENTS AND DISCLOSURES FROM ASU

1. "A DNA Replication System for High-level Rapid Production of Vaccines and Monoclonal Antibody Therapeutics in Plants" United States Patent 8513397. Inventors: Z. Huang, **Q. Chen**, B. Hjelm, C. Arntzen, H. Mason. (ASU received over \$110,000.00 royalty payment for this patent)
2. "Production of a Monoclonal Antibody Therapeutic against West Nile Virus in Plants" U.S. Patent Application filed 01/12/10. No. 61/293,828. Patent Approved by USPTO on December 11, 2013. Inventors: **Q. Chen**, H. Lai
3. "MAb Therapeutics against West Nile Virus with Improved CNS Penetration" U. S. Provisional Patent Application filed 06/08/11. No. 61/494,612. Inventors: **Q. Chen**, H. Lai, J. He.
4. "Plant-derived antibodies and derivatives that reduce risk of antibody-dependent enhancement (ADE) of infection" "U.S Patent application No. 61/932,033. Filed January 27, 2014. Inventors: **Q. Chen**, H. Lai.

5. "Cereal Endosperm Transcription Element/Factor-Based Expression System for Co-Expression of Large Multiple Proteins in Plants" Invention disclosure filed (AZTE case # M8-122). Inventors: **Q. Chen**, H. Lai

CURRENT SUPPORT

R21/R33 AI101329 (Chen, PI) 06/01/12 – 05/31/17
 NIH-NIAID \$1,768,636.00
 Bifunctional antibodies with targeted CNS delivery against West Nile virus
 The goal of this project is to develop blood-brain barrier permeable MAb therapeutics to enhance efficacy and extend the window of treatment for West Nile virus infection.

COMPLETED SUPPORT

OPP1043526 (Chen, PI) 11/01/11 – 04/30/13
 Bill & Melinda Gates Foundation \$100,000
 Alternative Delivery of Therapeutic Human Milk Proteins to Infants using Plants
 The major goal of this grant is to provide antibody-based proteins that have antibacterial and antiviral activities, enhance an infant's immune system, and increase the absorption of other nutrients.

1U01AI75549-01 (Chen, PI) 8/01/2007 – 7/31/2012
 NIH-NIAID \$1,500,000.00
 Plant-derived MAb Therapeutics for West Nile Virus
 The major goal of this project is to produce plant-derived monoclonal antibody E16 as a therapeutic agent for west Nile virus infection.

U19AI066332-01 (Arntzen PI, Chen, Co-PI) 07/01/2005-06/30/2012
 HHS-NIH-NIAID \$3,721,397.00
 Plant-derived Vaccines Against Hepatitis C Cooperative Research Center
 Major Goal is to test the capacity of plant cells and tissues to express genes derived from the Hepatitis C virus; to isolate the HCV-proteins from plant tissues and test them for their ability to stimulate immune responses in pre-clinical animal trials.

U19 AI 062150 (Arntzen, overall PI, Chen, Production Core PI) 9/1/2004 – 8/31/2012
 AHRQ \$7,453,234.00
 Plant Made Microbicides and Mucosal Vaccines for STIs
 The major goal of this project is to design and produce mucosal vaccines in plant expression systems for sexually transmitted viral diseases and to test these vaccines in pre-clinical animal trials.

U01AI061253 (Arntzen, PI, Chen, Co-PI) 3/15/2005 – 2/28/2011
 HHS-NIH-NIAID \$3,202,318.00
 Development of a Vaccine for Ebola Virus in Plant System
 The major goal of this project is to develop plant-expressed monoclonal antibody fusion proteins as a vaccine against Ebola virus.

Science Foundation of Arizona (SFAz) 7/1/2008 – 06/30/2009
 (Arntzen, PI, Chen, Co-PI) \$ 500,000.00
 Commercialization of Norovirus Vaccine Technology in an Arizona Spin-off Company

USDA-SBIR (Chen, PI) 9/1/2007 – 8/31/2008
 USDA \$100,000
 Targeted Homologous Recombination in Meiotic Plant Cells

This proposal aims to use geminivirus-based vectors as homologous recombination substrates for targeted gene changes in Arabidopsis.

U.S Department of Defense (Chen, PI)
DOD

08/1/2006 – 07/31/2007
\$30,963.00

Protein Production in Tobacco from an Amplified Inducible System

PROFESSIONAL SERVICE AND MEMBERSHIP

2012- Editorial board member, Journal of Advanced Technology in Biology and Medicine
2013- Lead guest editor, for a special issue of “Plant-Made Biologics” in journal BioMed Research International (former J. Biomed Biotech IF2.88).
2012- Science advisory board member, BioStrategies LC
2014 Panelist, NIH Peer Review: Cell, computational and Molecular Biology
2013 NIH grant review: 2013/5 ZRG1 1MST-J (15)
2012 Executive Panelist, NIH grant review: 2012/10 ZRG1 IMST-K (14): Cell, computational and Molecular Biology
2011 Panelist, NIH Peer Review: Development of Therapeutics for Biodefense ZAI1-AWA-M-C1
2010 Panelist, NSF Peer Review: Biotechnology, Biochemical, and Biomass Engineering
2008 Panelist, NIH Peer Review: Application of Platform Technologies for the Development of Therapeutics for Biodefense, ZA1 AR-M (C2).
2012 Grant reviewer, The Dr. Hadwen Trust for Humane Research
2010 Grant reviewer, US Army Medical Research and Materiel Command
2010 Grant reviewer, Thomas F. and Kate Miller Jeffress Memorial Trust
2006- Peer reviewer for > 20 Journals.
2012 Session Chair, 2012 European International Health Sciences Conference, Chair for Viral Diseases session. Rome, Italy (June 2012)
2011 Session Chair, Third International Congress of Antibodies-2011, Beijing, China
2010 Session Chair, Second International Congress of Antibodies-2010, Beijing, China
2010 Session Organizer, American Society of Agricultural and Biological Engineers, Annual Meeting,
2009 Session Chair, American Society of Agricultural and Biological Engineers, Annual Meeting
2006- Member, American Society of Agricultural and Biological Engineers
1990- Member, American Society of Plant Biologists