

## **THOMAS PETERSON**

### **Professor, and Pioneer Hi-Bred International Chair in Maize Molecular Genetics**

Department of Genetics, Development and Cell Biology

Department of Agronomy

2258 Molecular Biology Building

Iowa State University

Ames, Iowa 50011

Phone: 515-294-6345      Fax: 515-294-6755      e-mail: thomasp@iastate.edu

### **Education:**

1976: B.Sc. Zoology, Honors, University of California, Davis

1984: Ph.D. Biochemistry and Molecular Biology, University of California, Santa Barbara

1984: Participant, Molecular Biology of Plants Course, Cold Spring Harbor Laboratory, NY

### **Professional Experience:**

1979 – 1984: Graduate student with Dr. Steve Reed, Biology Department, UCSB.

Ph.D. thesis: Molecular genetic analysis of genes involved in cell cycle control in *S. cerevisiae*.

1984 – 1987: NSF Postdoctoral fellow with Dr. W.J. Peacock, CSIRO, Australia.

1987 -1993: Senior Staff Investigator, Cold Spring Harbor Laboratory, New York.

1991 - 1993: Genetics Program, State University of New York, Stonybrook, New York

1993 - present: Associate Professor; Full Professor; and Pioneer Chair in Maize Molecular Genetics, Department of Genetics Development and Cell Biology, and Department of Agronomy, Iowa State University, Ames, IA

### **Research Interests:**

Transposable elements, transposition mechanisms, and the effects of transposable elements on gene expression and genome evolution.

### **Publications**

Breter, H.J., J. Ferguson, T.A. Peterson, and S.I. Reed. 1983. The isolation and transcriptional characterization of three genes which function at start, the controlling event of the yeast cell cycle: CDC36, CDC37 and CDC39. *Mol. Cell. Biol.* 3: 881-891.

Peterson, T.A., J. Yochem, B. Byers, M.F. Nunn, P.H. Duesberg, R.F. Doolittle, and S.I. Reed. 1984. A relationship between the yeast cell cycle genes CDC4 and CDC36 and the ets sequence of oncogenic virus E26. *Nature* 309: 556-558.

Peterson, T.A., L. Prakash, S. Prakash, M.A. Osley, and S.I. Reed. 1985. Regulation of CDC9, the *Saccharomyces cerevisiae* gene that encodes DNA ligase. *Mol. Cell. Biol.* 5: 226-235.

Ferguson, J., J.Y. Ho, T.A. Peterson, and S.I. Reed. 1986. Nucleotide sequence of the yeast Cell Division Cycle Start genes CDC28, CDC36, CDC37, and CDC39, and a structural analysis of the predicted products. *Nucl. Acids Res.* 14: 6681-6697.

Lechelt, C., Peterson, T., Laird, A., Chen, J., Dellaporta, S., Dennis, E., Peacock, W.J., and Starlinger, P. 1989. Isolation and molecular analysis of the maize P locus. *Mol. Gen. Genet.* 219: 225-234.

Peterson, T. 1990. Intragenic transposition of Ac generates a new allele of the maize P gene. *Genetics* 126: 469-476.

- Athma, P. and Peterson, T. 1991. Ac induces homologous recombination at the maize P locus. *Genetics* 128: 163-173.
- Grotewold, E., Athma, P. and Peterson, T. 1991. Alternatively spliced products of the maize P gene encode proteins with homology to the DNA binding domain of Myb-like transcription factors. *Proc. Natl. Acad. Sci.* 88: 4587-4591.
- Grotewold, E., Athma, P. and Peterson, T. 1991. A possible hotspot for Ac insertion in the maize P gene. *Mol. Gen. Genet.*, 230: 329-331.
- Athma, P., Grotewold, E. and Peterson, T. 1992. Insertional mutagenesis of the maize P gene by intragenic transposition of Ac. *Genetics* 131: 199-209.
- Grotewold, E., and Peterson, T. 1994. Isolation and characterization of a maize gene encoding chalcone flavonone isomerase. *Mol. Gen. Genet.* 242:1-8.
- Grotewold, E., Drummond, B., Roth, B., Bowen, B., and Peterson, T. 1994. The Myb-homologous P gene controls phlobaphene pigmentation in maize floral organs by directly activating a flavonoid biosynthetic gene subset. *Cell* 76: 543 - 553.
- Chopra, S., Athma, P., and Peterson, T. 1996. Alleles of the maize P gene with distinct tissue specificities encode Myb-homologous proteins with C-terminal replacements. *The Plant Cell* 8: 1149 - 1158.
- Peterson, T. 1997. The *pl* Gene. In *Mutants of Maize*, M.G. Neuffer, E.H. Coe, S.R. Wessler, eds. Cold Spring Harbor Laboratory Press, New York.
- Chopra, S., Athma, P., and Peterson, T. 1998. A maize Myb-homolog is encoded by a stable multicopy gene complex. *Mol. Gen. Genet.* 260: 372-380.
- Sidorenko, L., Li, X., and Peterson, T. 1999. Characterization of the maize *P-rr* gene regulatory elements by transient assay. *Plant Mol. Biol.* 39: 11-19.
- Zhang, J., and Peterson, T. 1999. Genome rearrangements by non-linear transposons in maize. *Genetics* 153: 1403-1410
- Chopra, S., Brendel, V., Zhang, J., Axtell, J. D., and Peterson, T. 1999. Molecular characterization of a mutable pigmentation phenotype and isolation of the first active transposable element from *Sorghum bicolor*. *Proc. Natl. Acad. Sci.*, 96: 15330-15335.
- Xiao, Y-L and Peterson, T. 2000. Intrachromosomal homologous recombination in Arabidopsis induced by a maize transposon. *Mol Gen Genet* 263: 22-29.
- Sidorenko, L. V., Li, X., Cocciolone, S. M., Tagliani, L., Chopra, S., Bowen, B., Daniels, M., and Peterson, T. 2000. Complex structure of a maize *Myb* gene promoter: functional analysis in transgenic plants. *The Plant Journal* 22: 471-482.
- Cocciolone, S.M., Sidorenko, L.V., Chopra, S., Dixon, P.M., and T. Peterson. 2000. Hierarchical patterns of transgene expression indicate involvement of developmental mechanisms in the regulation of the maize *PI-rr* promoter. *Genetics* 156: 839 - 846.
- Xiao, Y., Li, X., and T. Peterson. 2000. Ac insertion site affects the frequency of transposon-induced homologous recombination at the maize P locus. *Genetics* 156: 2007 – 2017.
- Zhang, P., Chopra, S., T. Peterson. 2000. A segmental duplication generated differentially expressed Myb-homologous genes in maize. *The Plant Cell* 12: 1 - 12.
- Sidorenko, L. V., and T. Peterson. 2001. Transgene-induced silencing identifies sequences involved in the establishment of paramutation of the maize *PI-rr* gene. *Plant Cell* 13: 319-335.
- Cocciolone, S.M., Chopra, S., Flint-Garcia, S.A., McMullen, M.D., and T. Peterson. 2001. Tissuespecific patterns of a maize *Myb* transcription factor are epigenetically regulated. *Plant Journal* 27: 467-478.

- Chopra, S., Gevens, A., Svabek, C., Wood, K.V., Peterson, T., and Nicholson, R. L. 2002. Excision of the *Candystripe1* transposon from a hyper-mutable *Y1-cs* allele shows that the sorghum *Y1* gene controls the biosynthesis of both 3-deoxyanthocyanidin phytoalexins and phlobaphene pigments. *Phys. & Mol. Plant Path.*, 60: 321-330.
- Peterson, T., and B. Bonning. 2002. Trait Protection System: A Case Study. In Life Science Ethics, G. L. Comstock, ed. Iowa State Press.
- Xiao, Y.-L., and T. Peterson. 2002. *Ac* transposition is impaired by a small terminal deletion. *Mol. Gen. Genomics*, 266: 720 - 731.
- Sidorenko, L., Bruce, W., Maddock, S., Tagliani, L., Li, X., Daniels, M. and T. Peterson. 2003. Functional analysis of two Matrix Attachment Region (MAR) elements in transgenic maize plants. *Transgenic Research* 12, 137 – 154.
- Zhang, P., Wang, Y., Zhang, J., Maddock, S., Snook, M., and T. Peterson. 2003. A maize QTL for silk maysin levels contains duplicated Myb-homologous genes which jointly regulate flavone biosynthesis. *Plant Molecular Biology*, 52, 1 – 15.
- Chopra, S., Cocciolone, S., Bushman, S., Sangar, V., McMullen, M., and Peterson, T. 2003. The maize *Unstable Factor for Orange1* is a dominant epigenetic modifier of a tissue specifically silent allele of *pericarp color1*. *Genetics* 163, 1135 – 1146.
- Jiang, C., Gu, J., Gu, X., and Chopra, S. and T. Peterson. 2004. Ordered origin of the typical two- and three-repeat Myb genes. *Gene*, 326, 13 – 22.
- Zhang, J. and T. Peterson. 2004. Transposition of Reversed *Ac* Element Ends Generates Chromosome Rearrangements in Maize. *Genetics* **167**: 1929-1937.
- Jiang, C., Gu, X. and T. Peterson 2004. Identification of conserved gene structures and carboxyterminal motifs in the Myb gene family of *Arabidopsis* and *Oryza sativa* L. ssp. *indica*. *Genome Biol.* **5**: R46.
- Cocciolone, S.M., Nettleton, D., Snook, M.E., and T. Peterson. 2005. Transformation of maize with the *pl* transcription factor directs production of silk maysin, a corn earworm resistance factor, in concordance with a hierarchy of floral organ pigmentation. *Plant Biotechnology Journal* **3**: 225-235.
- Zhang, F. and T. Peterson. 2005. Comparisons of maize *pericarp color 1* alleles reveal paralogous gene recombination and an organ-specific enhancer region. *The Plant Cell* **17**: 903 – 914.
- Zhang, J. and T. Peterson. 2005. A Segmental Deletion Series Generated by Sister Chromatid Transposition of *Ac* Transposable Elements in Maize. *Genetics* 2005: 171: 333-344.
- Boddu, J., Sangar, V., Jiang, C., Olson, T., Peterson, T., and S. Chopra. 2006. Comparative structural and functional characterization of sorghum and maize duplications containing orthologous Myb transcription regulators of 3-deoxyflavonoid biosynthesis. *Plant Mol. Biol.* **60**: 185 – 199.
- Zhang, F. and T. Peterson. 2006. Gene conversion between direct non-coding repeats promotes genetic and phenotypic diversity at a regulatory locus of *Zea mays* (L.) *Genetics* **174**: 753 – 762.
- Zhang, J., Zhang, F., and T. Peterson. 2006. Transposition of Reversed *Ac* Element Ends Generates Novel Chimeric Genes in Maize. **PLoS Genet** **2(10)**: e164 DOI: [10.1371/journal.pgen.0020164](https://doi.org/10.1371/journal.pgen.0020164)
- Krishnaswamy, L., and T. Peterson. 2007. An alternate hypothesis to explain the high frequency of revertants in hothead mutants in *Arabidopsis*. *Plant Biology* 9: 30-31.

- Sekhon, R.S., Peterson, T., and S. Chopra. 2007. Epigenetic modifications of distinct sequences of the *p1* regulatory gene specify tissue-specific expression patterns in maize. *Genetics* 175:10591070.
- Krishnaswamy, L., Zhang, J., and T. Peterson. 2008. Reversed end *Ds* element: A novel tool for chromosome engineering in Arabidopsis. *Plant Molecular Biology* 68: 399-411.
- Gray J, Bevan M, Brutnell T, Buell CR, Cone K, Hake S, Jackson D, Kellogg E, Lawrence C, McCouch S, Mockler T, Moose S, Paterson A, Peterson T, Rokhsar D, Souza GM, Springer N, Stein N, Timmermans M, Wang GL, Grotewold E. 2009. A recommendation for naming transcription factor proteins in the grasses. *Plant Physiol.* 149:4-6.
- Zhang, J., Peterson, T. and Peterson, P. 2009. Transposons *Ac/Ds*, *En/Spm* and their relatives in maize, pp. 251-276 in *Maize Handbook*, eds. Bennetzen, J. and Hake, S. Springer.
- Zhang, J., Yu, C., Pulletikurti, V., Lamb, J., Danilova, T., Weber, D., Birchler, J. and Peterson, T. 2009. Alternative *Ac/Ds* transposition induces major chromosomal rearrangements in maize. *Genes & Dev.* 2009. 23: 755-765.
- Pulletikurti, V., Yu, C., Zhang, J., Peterson, T., and Weber, D.F. 2009. Cytological Evidence that Alternative Transposition by *Ac* Elements Causes Reciprocal Translocations and Inversions in *Zea mays* L. *Maydica* 54: 457-462.
- Krishnaswamy, L., Zhang, J., and Peterson, T. 2010. Fusion of reverse-oriented *Ds* termini following alternative transposition in Arabidopsis: Implications for the mechanism of *Ac/Ds* transposition. *Plant Cell Rep* DOI 10.1007/s00299-010-0832-x
- Yu, C., Zhang, J., Pulletikurti, V., Weber, D.F., and T. Peterson. 2010. Spatial configuration of *Ac* termini affects their ability to induce chromosomal breakage. *The Plant Cell* 22:744-754.
- C. Yu, T. Danilova, J. Zhang, J. Birchler, T. Peterson 2010 Constructing Defined Chromosome Segmental Duplications in Maize. *Cytogenet Genome Res* 129:72-81
- Zhang F, Maeder ML, Unger-Wallace E, Hoshaw JP, Reyon D, Christian M, Li X, Pierick CJ, Dobbs D, Peterson T, Joung JK, Voytas DF. 2010. High frequency targeted mutagenesis in Arabidopsis thaliana using zinc finger nucleases. *Proc Natl Acad Sci U S A.* 107(26):1202833.
- Yu, C., Zhang, J., and Peterson, T. 2011. Genome Rearrangements in Maize Induced by Alternative Transposition of Reversed *Ac/Ds* Termini. *Genetics* 188: 59-67.
- Vitte, C., Peterson, T., and J. Bennetzen. 2011. Transposable elements and the evolving structure of the maize genome. In *Advances in Maize* (editor: J.-L. Prioul)
- Xuan, Y.H., H.L. Piao, B.I. Je, S.J. Park, S.H. Park, J. Huang, J. Zhang, T. Peterson, and C.D. Han, 2011. Transposon *Ac/Ds*-induced chromosomal rearrangements at the rice *OsRLG5* locus. *Nucleic Acids Research* 39: 22 e149 doi:10.1093/nar/gkr718
- Zhang, J., Yu, C., Krishnaswamy, L., and Peterson, T. 2011. Transposable elements as catalysts for chromosome rearrangements *Methods Mol Biol* 701: 315-326.
- Yu, C., Han, F., Zhang, J., Birchler, J., and T. Peterson. 2012. A transgenic system for generation of transposon *Ac/Ds*-induced chromosome rearrangements in rice. *Theor Appl Genet.* 125: 1449 - 1462.
- Xuan, Y.H., J. Zhang, T. Peterson, and C.D. Han. 2012. *Ac/Ds*-induced chromosomal rearrangements in rice genomes, *Mobile Genetic Elements*, 2: 67 – 71.
- Peterson, T. and Zhang, J. 2012. The mechanism of *Ac/Ds* transposition. In *Plant Transposons and Genome Dynamics in Evolution*, Nina V. Fedoroff, editor. Wiley-Blackwell, 2013.
- Zhang J, Zuo T, Peterson T. 2013. Generation of Tandem Direct Duplications by Reversed-Ends Transposition of Maize *Ac* Elements. *PLoS Genet* 9(8): e1003691. doi:10.1371/journal.pgen.1003691

Plant Transposable Elements, Methods and Protocols, in *Methods in Molecular Biology*, Volume 1057. T. Peterson, editor. Humana Press, 2013.

Krishnaswamy L, Peterson T. 2013. Survey of natural and transgenic gene markers used to monitor transposon activity. *Methods Mol Biol.* 1057:43-58. doi: 10.1007/978-1-62703-5682\_4.

Wang D, Peterson T. 2013. Isolation of sequences flanking Ac insertion sites by Ac casting. *Methods Mol Biol.* 1057:117-122. doi: 10.1007/978-1-62703-568-2\_8

Zhang, J., Zuo, T., Wang, D., and Peterson, T. 2014. Transposition-mediated DNA re-replication in maize. *eLife* 2014;3:e03724

Wang, D., Yu, C., Zuo, T., Zhang, J., Weber, D.F., and Peterson, T. Alternative transposition generates segmental duplications and new chimeric genes at the maize *pl* locus. *Genetics*, 2015 Oct 4. pii: genetics.115.178210. [Epub ahead of print]

Xuan, Y.H., Peterson, T., and Han, C. Generation and Analysis of Transposon *Ac/Ds*-Induced Chromosomal Rearrangements in Rice Plants. *Methods in Molecular Biology*, accepted.

Zuo, T., Zhang, J., Lithio, A., Dash, S., Weber, D.F., Wise, R., Nettleton, D., and Peterson, T. Genes and small RNA transcripts exhibit dosage-dependent expression pattern in maize copy-number alterations. Submitted to *PLOS Genetics*.

### **Manuscripts in preparation:**

Wang, D., Yu, C., Zhang, J., and Peterson, T. Excision and reinsertion of *Ac* macrotransposons in maize.

Zhang, J. Zuo, T., Danilova, T., Birchler, J., and Peterson, T. Effects of a large inverted duplication on chromosome pairing and recombination in maize.

### **Honors and Awards:**

Pioneer Hi-Bred International Chair in Maize Molecular Genetics, 1993 to present.

Fellow of the American Association for the Advancement of Science, Section on Biological Sciences, *For advances in understanding of transposable elements and their roles in altering genome evolution, and application of that knowledge to genome engineering.* 2012.

### **Professional Service Affiliations:**

Member, American Association for the Advancement of Science

Member, Genetics Society of America

### **Major Service Activities, Iowa State University:**

Biotechnology Council 1994 – 1997.

Chair, ISU Plant Sciences Planning Committee, 1996 – 1997.

ISU Faculty Research Advisory Committee, 1999.

ISU GMO Task Force, 1999.

ISU USDA PGSB Grants Management Committee

Organizing Committee (chair), ISU Plant Sciences Symposium on “Transposition, Recombination, and Application to Plant Genomics”, 2002-2003 MGD<sub>b</sub> (Maize Genome Database) ISU Advisory Board

### **Editorial Boards:**

*BMC Plant Biology*, Associate Editor  
*Maydica*, Member of Editorial Board

**Reviewed manuscripts for the following journals:**

*American Antiquity*, *BMC Genomics*, *BMC Plant Biology*, *Gene*, *Genetica*, *Genetics*, *Genome*, *ILSI International Food Biosafety Committee*, *Journal of Heredity*, *Maydica*, *Molecular and General Genetics*, *Molecular Genetics and Genomics*, *Plant Cell*, *Plant Molecular Biology*, *Plant Physiology*, *Plant Science*, *PLOS Genetics*, *Proceedings of the National Academy of Sciences, USA*, *The Plant Journal*

**Service on Grant Proposal Review Panels:**

USDA-NRICGP, “Plant Genetic Mechanisms” panel, 1998.

USDA-NRICGP, “Plant Genetic Mechanisms” panel, 2002. USDA-NRICGP, “Gene Function and Regulation” panel, 2008

**Provided *ad hoc* reviews of research proposals for the following agencies:**

Marsden Fund, New Zealand; NSF, Eukaryotic Genetics; USDA, Plant Genome Program; USDA, Plant Genetic Mechanisms; U.S.-Israel Binational Agricultural Research and Development Fund (BARD); Council for the Earth and Life Sciences, Netherlands

**Professional Service:**

**Organizer, Mini-Symposium:** “Flavonoid Biosynthesis in Maize: A Collection of Interacting Factors”; 1996, Iowa State University.

**Organizer and moderator, Maize Transformation Workshop,** Maize Genetics Meeting, March 1998, Lake Geneva, Wisconsin.

**Chair, Organizational Committee for ISU Plant Sciences Institute Symposium:** "Transposition, Recombination and Applications to Plant Genomics", June 2003, Iowa State University.

**Co-Chair, “Transposable Elements” Symposium:** 9th International Plant Molecular Biology Congress, October 2009, St. Louis, Missouri.