Stanford



Kathryn Barton

Associate Professor, Biology

CONTACT INFORMATION

- **Alternate Contact**

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Bio

BIO

Kathryn Barton attended elementary school in Oak Park, Ill and grades 6 through high school (Humanistiska Linjen) in Göteborg and Mölndal, Sweden. In 1978 she returned to the United States to attend college at the University of Wisconsin-Madison. She was inspired to study genetics and developmental biology by undergraduate coursework she took at the UW. In particular the Biocore curriculum, a two-year, in depth survey course, was influential. In addition to offering excellent lectures by faculty experts, this course afforded her the opportunity to pursue an independent laboratory project in William Engels' lab in the Department of Genetics. Her project was to estimate the rate of new P element insertion on the X chromosome in a hybrid dysgenic Drosophila. Other undergraduate lab work included dishwashing in a Department of Plant Pathology lab and fieldwork for maize geneticist Jerry Kermicle. She received her B.S. in Molecular Biology in 1983.

She did graduate research in Dr. Judith Kimble's lab, also at the University of Wisconsin. There, she worked to understand how hermaphrodites of the nematode worm C. elegans make two kinds of germ cells, sperm and eggs. This work helped identify three genes - FEM3, FOG1 and GLD1 - that direct germ cells down either a sperm or an oocyte pathway of development. She received her Ph.D. in Genetics in 1989.

In 1989, she began postdoctoral work in plant biology in Dr. Scott Poethig's lab at the University of Pennsylvania. There she isolated Arabidopsis mutants – SHOOTMERISTEMLESS, TOPLESS and PINHEAD/AGO10 - with defects in the shoot apical meristem. Among these were mutants that entirely lacked a shoot apical meristem but had near normal cotyledons. This established that it was possible to separate the process of cotyledon formation from shoot apical meristem formation. It also established the SHOOTMERISTEMLESS gene as a factor specifically required for shoot apical meristem formation in the embryo. She left the University of Pennsylvania in 1992 to return to the Department of Genetics at the University of Wisconsin – Madison as a faculty member.

As an assistant, and later associate, professor she continued work on shoot apical meristem and embryo development. Her lab cloned the SHOOTMERISTEMLESS gene and showed it to be a KNOTTED like transcription factor. This cemented the understanding of the role of KNOTTED like factors in meristem formation and maintenance. Mutations in the BOBBER gene (later shown to encode a heat shock factor) were shown to limit the extent of SHOOTMERISTEMLESS RNA expression to meristematic cells. Her lab also identified a novel dominant mutation (called phabulosa-1d) affecting leaf polarity and showed this to be due to a mutation in a member of the plant HomeoDomain Leucine Zipper gene family.

Besides being important in understanding the establishment of leaf polarity, these mutations were later useful in establishing the role of small RNAs in leaf development.

She became affiliated with Stanford Biology in 2001 when her lab moved to the Carnegie Institution's Department of Plant Biology (located on the Stanford campus).. There, her lab continues to study the genetic control of shoot apical meristem function and the establishment of leaf polarity using molecular genetics. (See Research Description for details.)

She pursues teaching in a variety of formats. At Carnegie DPB she has helped run the Summer Intern Research Program for students interested in trying their hand at plant research. (Interested students should see the link at https://dpb.carnegiescience.edu/education/summer-internship-program). She teaches a freshman seminar on Hunger at Stanford. She guest lectures at area high schools. She writes a blog called Vanishing Bananas (www.vanishingbananas.blogspot.com) on various fun observations made on plants inside and outside the lab.

ACADEMIC APPOINTMENTS

- Associate Professor, Biology

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Board Member, Scientific Advisory Board, Max Planck Institute for Plant Breeding Research (2014 - present)
- Board Member, International Plant Molecular Biology Board (2013 - present)
- Standing Member, Molecular Genetics B Study Section, NIH (2012 - present)

PROFESSIONAL EDUCATION

- B.S., University of Wisconsin-Madison , Molecular Biology (1983)
- Ph.D., University of Wisconsin-Madison , Genetics (1989)

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Plants make new leaves and stems from clusters of undifferentiated cells located at the tips of branches. These cell clusters are called apical meristems. We study transcription factors that control growth and development of apical meristems. Our studies include plants growing in environments rich in water and nutrients as well as in poor environments. The deeper knowledge of plant development gained from these studies will ultimately help increase food security in a changing environment.

Teaching

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biology (School of Humanities and Sciences) (PhD Program)

Publications

PUBLICATIONS

- **Arabidopsis KANADI1 acts as a transcriptional repressor by interacting with a specific cis-element and regulates auxin biosynthesis, transport and signaling in opposition to HD-ZIPIII factors.** *Plant Cell*
  Huang, T., Harrar, Y., Lin, C., Reinhart, B., Newell, N. R., Talavera-Rauh, F., Hokin, S. A., Barton, M. K., Kerstetter, R. A.
  2014; in press
- **Establishing a Framework for the Ad/abaxial Regulatory Network of Arabidopsis - Ascertaining Targets of HD-ZIPIII and KANADI Regulation** *Plant Cell*

Reinhart, B. J., Liu, T., Newell, N. R., Magnani, E., Huang, T., Kerstetter, R. A., Michaels, S., Barton, M. K.
2013; 25 (9): 3228-3249

- **Brassinosteroids regulate organ boundary formation in the shoot apical meristem of Arabidopsis** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Gendron, J. M., Liu, J., Fan, M., Bai, M., Wenkel, S., Springer, P. S., Barton, M. K., Wang, Z.
  2012; 109 (51): 21152-21157
- **Plan B for Stimulating Stem Cell Division** *PLOS GENETICS*
  Barton, M. K.
  2012; 8 (11)
- **Genome-wide binding-site analysis of REVOLUTA reveals a link between leaf patterning and light-mediated growth responses** *PLANT JOURNAL*
  Brandt, R., Salla-Martret, M., Bou-Torrent, J., Musielak, T., Stahl, M., Lanz, C., Ott, F., Schmid, M., Greb, T., Schwarz, M., Choi, S., Barton, M. K., Reinhart, et al
  2012; 72 (1): 31-42
- **Of Blades and Branches: Understanding and Expanding the Arabidopsis Ad/abaxial Network Through Target Identification** *Cold Spring Harbor Symposia On Quantitative Biology*
  Liu, T., Reinhart, B. J., Magnani, E., Huang, T., Kerstetter, R. A., Barton, M. K.
  2012; 77 (1): 31-45
- **A Per-ARNT-Sim-Like Sensor Domain Uniquely Regulates the Activity of the Homeodomain Leucine Zipper Transcription Factor REVOLUTA in Arabidopsis** *PLANT CELL*
  Magnani, E., Barton, M. K.
  2011; 23 (2): 567-582
- **Twenty years on: The inner workings of the shoot apical meristem, a developmental dynamo** *DEVELOPMENTAL BIOLOGY*
  Barton, M. K.
  2010; 341 (1): 95-113
- **Partitioning the Apical Domain of the Arabidopsis Embryo Requires the BOBBER1 NudC Domain Protein** *PLANT CELL*
  Jurkuta, R. J., Kaplinsky, N. J., Spindel, J. E., Barton, M. K.
  2009; 21 (7): 1957-1971
- **A feedback regulatory module formed by LITTLE ZIPPER and HD-ZIPIII genes** *PLANT CELL*
  Wenkel, S., Emery, J., Hou, B., Evans, M. M., Barton, M. K.
  2007; 19 (11): 3379-3390
- **The ins and outs of Arabidopsis embryogenesis** *DEVELOPMENTAL CELL*
  Barton, M. K.
  2007; 12 (6): 849-850
- **Making holes in leaves: Promoting cell state transitions in stomatal development** *PLANT CELL*
  Barton, M. K.
  2007; 19 (4): 1140-1143
- **Interactions between the cell cycle and embryonic patterning in Arabidopsis uncovered by a mutation in DNA polymerase epsilon** *PLANT CELL*
  Jenik, P. D., Jurkuta, R. E., Barton, M. K.
  2005; 17 (12): 3362-3377
- **Surge and destroy: the role of auxin in plant embryogenesis** *DEVELOPMENT*
  Jenik, P. D., Barton, M. K.
  2005; 132 (16): 3577-3585
- **MicroRNA binding sites in Arabidopsis class IIIHD-ZIP mRNAs are required for methylation of the template chromosome** *DEVELOPMENTAL CELL*
  Bao, N., Lye, K. W., Barton, M. K.
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- **Plant biology - Plant acupuncture: Sticking PINs in the right places** *SCIENCE*
  Kaplinsky, N. J., Barton, M. K.
  2004; 306 (5697): 822-823
- **MicroRNA control of PHABULOSA in leaf development: importance of pairing to the microRNA 5 ' region** *EMBO JOURNAL*
  Mallory, A. C., Reinhart, B. J., Jones-Rhoades, M. W., Tang, G. L., Zamore, P. D., Barton, M. K., Bartel, D. P.
  2004; 23 (16): 3356-3364
- **Leaf development takes shape** *SCIENCE*
  McConnell, J. R., Barton, M. K.
  2003; 299 (5611): 1328-1329
- **Regulation of axis determinacy by the Arabidopsis PINHEAD gene** *PLANT CELL*
  Newman, K. L., Fernandez, A. G., Barton, M. K.
  2002; 14 (12): 3029-3042
- **Transformation of shoots into roots in Arabidopsis embryos mutant at the TOPLESS locus** *DEVELOPMENT*
  Long, J. A., Woody, S., Poethig, S., Meyerowitz, E. M., Barton, K.
  2002; 129 (12): 2797-2806
- **Giving meaning to movement** *CELL*
  Barton, M. K.
  2001; 107 (2): 129-132
- **Rescue of the shootmeristemless (stm) mutant phenotype by expression of STM mRNA in a subset of its normal domain: Implications for nonautonomous action of the STM transcription factor in Arabidopsis thaliana.**
  Fernandez, A. G., Long, J. A., Joy, R. E., Barton, M. K.
  ACADEMIC PRESS INC ELSEVIER SCIENCE.2001: 260–60
- **Role of PHABULOSA and PHAVOLUTA in determining radial patterning in shoots** *NATURE*
  McConnell, J. R., EMERY, J., Eshed, Y., Bao, N., Bowman, J., Barton, M. K.
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- **Leaving the meristem behind: regulation of KNOX genes** *GENOME BIOLOGY*
  Barton, M. K.
  2001; 2 (1)
- **Initiation of axillary and floral meristems in Arabidopsis** *DEVELOPMENTAL BIOLOGY*
  Long, J., Barton, M. K.
  2000; 218 (2): 341-353
- **Growth and development - Plants from genes: towards the information network - Editorial overview** *CURRENT OPINION IN PLANT BIOLOGY*
  Barton, K., Scheres, B.
  2000; 3 (1): 13-16
- **Shoot apical meristem formation and function in Arabidopsis.**
  Barton, M. K.
  AMER SOC CELL BIOLOGY.1999: 2A–2A
- **The PINHEAD/ZWILLE gene acts pleiotropically in Arabidopsis development and has overlapping functions with the ARGONAUTE1 gene** *DEVELOPMENT*
  Lynn, K., Fernandez, A., Aida, M., Sedbrook, J., Tasaka, M., Masson, P., Barton, M. K.
  1999; 126 (3): 469-481
- **The development of apical embryonic pattern in Arabidopsis** *DEVELOPMENT*
  Long, J. A., Barton, M. K.
  1998; 125 (16): 3027-3035
- **Leaf polarity and meristem formation in Arabidopsis** *DEVELOPMENT*

McConnell, J. R., Barton, M. K.
1998; 125 (15): 2935-2942

- **Cell type specification and self renewal in the vegetative shoot apical meristem** *CURRENT OPINION IN PLANT BIOLOGY*
  Barton, M. K.
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- **Genetics of angiosperm shoot apical meristem development** *ANNUAL REVIEW OF PLANT PHYSIOLOGY AND PLANT MOLECULAR BIOLOGY*
  Evans, M. M., Barton, M. K.
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- **Hormonal studies of fass, an Arabidopsis mutant that is altered in organ elongation** *PLANT PHYSIOLOGY*
  Fisher, R. H., Barton, M. K., Cohen, J. D., Cooke, T. J.
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- **A member of the KNOTTED class of homeodomain proteins encoded by the STM gene of Arabidopsis** *NATURE*
  Long, J. A., MOAN, E. I., Medford, J. I., Barton, M. K.
  1996; 379 (6560): 66-69

- **GLD-1, A TUMOR-SUPPRESSOR GENE REQUIRED FOR OOCYTE DEVELOPMENT IN CAENORHABDITIS-ELEGANS** *GENETICS*
  Francis, R., Barton, M. K., Kimble, J., Schedl, T.
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- **EFFECT OF MUTATIONS IN THE PINHEAD GENE OF ARABIDOPSIS ON THE FORMATION OF SHOOT APICAL MERISTEMS** *DEVELOPMENTAL GENETICS*
  McConnell, J. R., Barton, M. K.
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- **FORMATION OF THE SHOOT APICAL MERISTEM IN ARABIDOPSIS-THALIANA - AN ANALYSIS OF DEVELOPMENT IN THE WILD-TYPE AND IN THE SHOOT MERISTEMLESS MUTANT** *DEVELOPMENT*
  Barton, M. K., Poethig, R. S.
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- **GENETIC-ANALYSIS OF MERISTEM STRUCTURE AND FUNCTION IN ARABIDOPSIS-THALIANA** *21ST STEENBOCK SYMP ON CELLULAR COMMUNICATION IN PLANTS*
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- **FOG-1, A REGULATORY GENE REQUIRED FOR SPECIFICATION OF SPERMATOGENESIS IN THE GERM LINE OF CAENORHABDITIS-ELEGANS** *GENETICS*
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- **GENETIC-CONTROL OF SEX DETERMINATION IN THE HERMAPHRODITE GERM LINE OF CAENORHABDITIS-ELEGANS** *48TH ANNUAL SYMP OF THE SOC FOR DEVELOPMENTAL BIOLOGY : GENETICS OF PATTERN FORMATION AND GROWTH CONTROL*
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- **ANALYSIS OF THE ROLE OF TRA-1 IN GERMLINE SEX DETERMINATION IN THE NEMATODE CAENORHABDITIS-ELEGANS** *GENETICS*
  Schedl, T., Graham, P. L., Barton, M. K., Kimble, J.
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