

MECHANICAL ENGINEERING DEPARTMENT  
ME/IE 8773-8774

DESIGN & MANUFACTURING SERIES

Topic: BIO-MIMETICS

Host: Kim A. Stelson

Biomechanics of Plant Habit

by

Wendy K. Silk

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Wednesday, December 14, 2005

3:30-5:00 p.m.

Room 1130 ME

Coffee and refreshments will be available at 3:15 p.m. in Room 1130 ME before the seminar

**ABSTRACT** — Curved and twisted structures are common in nature. Emphasizing that steady and non-steady forms are produced from changing cells, I will review the kinematics of plant stem curvature and torsion. Concepts from fluid dynamics are useful to find the growth rate patterns that cause bending. The geometry of the kinematics problems also helps to analyze the mechanics of leaf bending and stem twining. Maize leaf form involves a coupling between transverse and longitudinal curvature; fiber development is proposed as the motor driving the leaf curvature. The mechanics of twining is analyzed with a force balance in a helix. A “rope around a pole” model explains some aspects of the stability of the twining habit. The possible functional importance of many of the geometrical regularities of twining plants remains a mystery. Related articles include: Silk, W.K. 1984. Quantitative descriptions of development. *Annual Reviews of Plant Physiology* 35:479-518. Silk W.K. and Holbrook, N.M. 2005. The importance of frictional interactions in maintaining the stability of the twining habit. *American Journal of Botany*, IN PRESS.

**BIO** — Wendy K. Silk received a B.A. degree (Applied Mathematics in Biology), from Harvard University (Radcliffe), and a Ph.D. degree (Botany Plant Physiology), University of California, Berkeley. She was a Postdoctoral associate and worked on Modeling of plant development at the University of Pennsylvania. Some of her recent projects include interactions between root growth zones and the surrounding soil (funded by USDA, Kearney), Biomechanics of plant habit (funded by NSF), Biogeochemical cycling of copper and zinc in a riparian habitat (pilot project), root-rhizosphere interactions and microbial resistance in wheat (CSIRO, GRDC Australia), and hydraulics of root growth. Prof. Silk has served on the editorial boards of the *American Journal of Botany* since 1993, *Planta* since 1994, and *Plant Cell and Environment* since 1998. She has served on scientific organizing committees for international symposia in the emerging field of plant mechanics: East Lansing, USA 2003; Badenweiler, Germany 2000; Redding, U.K. 1997; Montpellier, France 1994. She was co-chair for a session on mechanics of growth at the International Botanical Congress, St. Louis, 1999. Her teaching interests include an *Interdisciplinary course on Water and Society*, Graduate core course on environmental plant physiology, and undergraduate courses on plant growth analysis, and plant stress physiology, and seminar courses on plant-soil-water interactions and nutrition of growing plant tissue.

Informal Faculty Luncheon: Wednesday, December 14, 2005, 12:00 noon. Meet in 1100 ME and walk to lunch with other faculty. Prof. Wendy Silk will be able to attend.