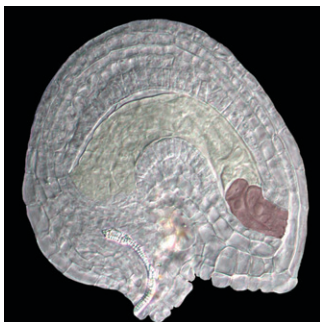


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**PLANT**  
C E L L

Volume 19 Number 11 November 2007

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**ON THE COVER**



Establishment of cell fate in the female gametophyte follows a predictable pattern. Pagnussat et al. (pages 3578–3592) characterize the *Arabidopsis eostre* mutant, in which this pattern is perturbed and an additional egg cell is formed in place of a synergid. The authors show that the *eostre* phenotype is due to misexpression of *BELL-LIKE HOMEODOMAIN1*, resulting in ectopic activity of BELL-KNOX TALE protein complexes. They find that normal development of the embryo sac depends on suppression of BELL-KNOX TALE complex activity, which is likely mediated by OVATE family proteins. The cover shows a false-color image of an *eostre* mutant ovule, in which two zygotes (purple) have begun to develop after fertilization of the two egg cells within the embryo sac (pale yellow). The unfertilized central cell nucleus is positioned just above the zygotes but out of the focal plane.

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- Claudia Kutter, Hanspeter Schöb, Michael Stadler, Frederick Meins, Jr., and Azeddine Si-Ammour (2007). MicroRNA-Mediated Regulation of Stomatal Development in *Arabidopsis*. *Plant Cell* 19: 2417–2429. **3831**
- Shinji Terakura, Yoshihisa Ueno, Hideaki Tagami, Saeko Kitakura, Chiyoko Machida, Hiroetsu Wabiko, Hiroji Aiba, Léon Otten, Hironaka Tsukagoshi, Kenzo Nakamura, and Yasunori Machida (2007). An Oncoprotein from the Plant Pathogen *Agrobacterium* Has Histone Chaperone-Like Activity. *Plant Cell* 19: 2855–2865. **3832**
- Kentaro Tamura, Hideyuki Takahashi, Tadashi Kunieda, Kentaro Fuji, Tomoo Shimada and Ikuko Hara-Nishimura (2007). *Arabidopsis* KAM2/GRV2 Is Required for Proper Endosome Formation and Functions in Vacuolar Sorting and Determination of the Embryo Growth Axis. *Plant Cell* 19: 320–332. **3833**

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*The Plant Cell* (ISSN 1040-4651, online ISSN 1531-298X) is published monthly (one volume per year) by the American Society of Plant Biologists, 15501 Monona Drive, Rockville, MD 20855-2768, and is produced by Dartmouth Journal Services, Waterbury, VT. The institutional price for the print and online versions is based on type of institution; contact [institution@aspb.org](mailto:institution@aspb.org). A subscription includes both *The Plant Cell* and *Plant Physiology*; single copies may be purchased for \$75 each, plus \$7 shipping (U.S.) or \$9 (outside U.S.). Members of the American Society of Plant Biologists may subscribe to *The Plant Cell* for \$160. Nonmember individuals may subscribe for \$325. For matters regarding subscriptions, contact Suzanne Cholwek, ASPB, 15501 Monona Drive, Rockville, MD 20855-2768; telephone 301/251-0560, ext. 141; fax 301/251-6740; e-mail [scholwek@aspb.org](mailto:scholwek@aspb.org). Notify ASPB in writing within 3 months (domestic) or 6 months (foreign) of issue date, and defective copies or copies lost in the mail will be replaced. Send all inquiries regarding display advertising to FASEB AdNet, 9650 Rockville Pike, Bethesda, MD 20814-3998; telephone 301/634-7791; fax 301/634-7153; e-mail [adnet@faseb.org](mailto:adnet@faseb.org). Periodicals postage paid at Rockville, MD 20850, and at additional mailing offices.

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