Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Patterns for Fluid Management: The Mechanical Origins of Microarchitectures ASJA RADJA, MAXIM LAVRENTOVICH , ERIC HORSLEY, RANDALL KAMIEN, ALISON SWEENEY, University of Pennsylvania — Pollen grains are the vehicles for the male germ line in land plants and are famous for the intricate microarchitectures of their protective coverings. It is not known whether these sub-micron-scale patterns have a functional role. A given microarchitectural pattern is maintained over geological time within a single species, yet, despite similar mechanisms of pollen development in all species, different species have extremely variable patterns. Until recently, many proposed mechanisms of pollen pattern formation were attributed to top-down assembly processes directed by the pollen cytoskeleton. We propose a novel view in which bottom-up mechanical processes akin to thermodynamic phase transitions may cause the final pollen structure. Here, we present a temporal view of pattern formation using several microscopy techniques. Our data show a rapid appearance of surface microstructures. We test the hypothesis of bottom-up pattern formation by physically manipulating the pattern formation process with mechanical forces and chemical solvents. Our data are consistent with bottom-up formation of these patterns; we discuss a hypothesis of pattern formation in this system involving Brazovskii phase transitions templated on a spherical geometry.

Asja Radja
University of Pennsylvania

Date submitted: 03 Nov 2015 Electronic form version 1.4