Abstract Submitted
for the TSF19 Meeting of
The American Physical Society

Cellular Constriction Chains in the Drosophila Embryo: Mechanical Feedback and Robustness of Morphogenetic Movements[1] MICHAEL HOLCOMB, Dept of Physics and Astronomy, TTU; Dept of Physics and Geosciences, Angelo State Univ, GUO-JIE GAO, Dept of Mathematical and Systems Engineering, Shizuoka Univ, MAHSA SERVATI, Dept of Physics and Astronomy, TTU; Sch of Health and Sci, Purdue Univ, DYLAN SCHNEIDER, Dept of Mechanical Engineering, TTU, PRESLEY MCNEELY, Dept of Physics and Astronomy, TTU, JEFFREY THOMAS, Dept of Cell Biology and Biochemistry, TTU Health Sci Ctr, JERZY BLAWZDZIEWICZ, Dept of Mechanical Eng, TTU; Dept. of Physics and Astronomy, TTU — The key process that initiates Ventral Furrow Formation (VFF) in the Drosophila embryo is the constriction of outer side (apical) cells on the underside (ventral side) of the embryo. The cellular constrictions of individual cells combine to produce a spontaneous negative curvature that buckles the tissue inwards. We have previously treated apical cells as an active granular fluid and shown that the apical constrictions during this initial phase of VFF produce well-defined patterns, now known as cellular constriction chains (CCCs). We argue that CCCs are a signature of intercellular coordination via tensile mechanical stress and provide a statistical comparison between our active granular fluid model of the embryo's outer surface and processed high-resolution confocal microscopy time lapses of live embryos. Additionally, we demonstrate that CCCs can penetrate or bypass pockets of cells with reduced apical constriction probability, and we argue that CCC formation increases robustness of VFF to spatial variation of cellular contractility.

[1]J.B. was partially supported by NSF Grant CBET 1603627. J.T. received support from the South Plains Foundation.

Michael Holcomb
Angelo State Univ

Date submitted: 30 Sep 2019 Electronic form version 1.4