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Cell packing in the notochord: morphometry, pattern, and forces

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Abstract. The notochord, the defining feature of chordates, is a pressurized tube which actuates elongation of the chordate embryo. The zebrafish notochord consists of large vacuolated cells surrounded by a thin sheath. We characterized the patterns of the cells' packing, and their relationship to the known regular patterns from the study of foams, and irregular patterns in a gel bead system. Disruption of the wild type packing pattern leads to developmental defects. By constructing a suite of models of the physics of cell packing in regular patterns the notochord, we have determined key parameter ratios governing the packing pattern, cell and tissue morphometry, and derived surprisingly simple expressions for key morphometric quantities in terms of tension ratios.