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Membrane Elastegrities: A New Model Viscoelastic Structure ELEFTHERIOS PAVLIDES, JENNIFER PEARCE, Roger Williams University — We propose a new class of structures, membrane elastegrities, a network of rigid and elastic members maintaining shape through elastic forces, named by analogy to tensegrities that maintain shape through tension alone. Numerous researchers have proposed tensegrities as models to biological structure. Elastegrities expand tensegrity properties primarily by suggesting a mechanism for containing and pumping non-Newtonian fluids in living organisms. The chiral icosahedral elastegrity compared to the 6-strut tensegrity have identical symmetry, negative Poisson Ratio, and the reaction force to external forces is distributed throughout the elastic members causing reversible deformation. They also have important differences: a) elastic hinge connections enable containment and pumping of fluids versus nodal connections, b) simple assembly by folding a flat shape-memory material versus assembly requiring scaffolding, c) hinge connections limit freedom of movement resulting in isometric forces as members rotate cooperatively contracting versus large freedom of movement with unpredictable deformation. d) The chiral icosahedral elastegrity can contain liquid and requires increased force for equal displacement as it rotates towards a zero volume octahedron suggesting a mechanism for a non-Newtonian pump.

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