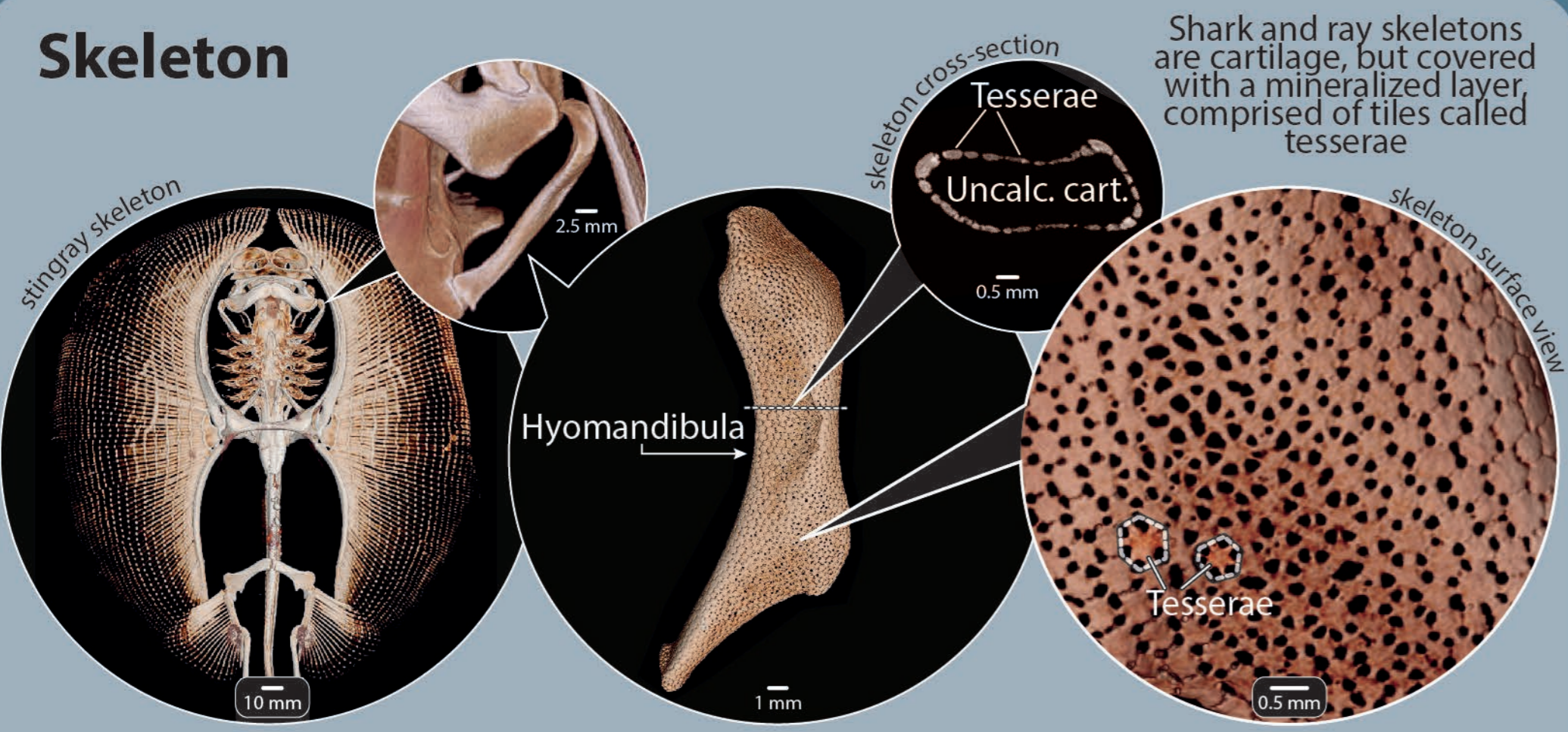
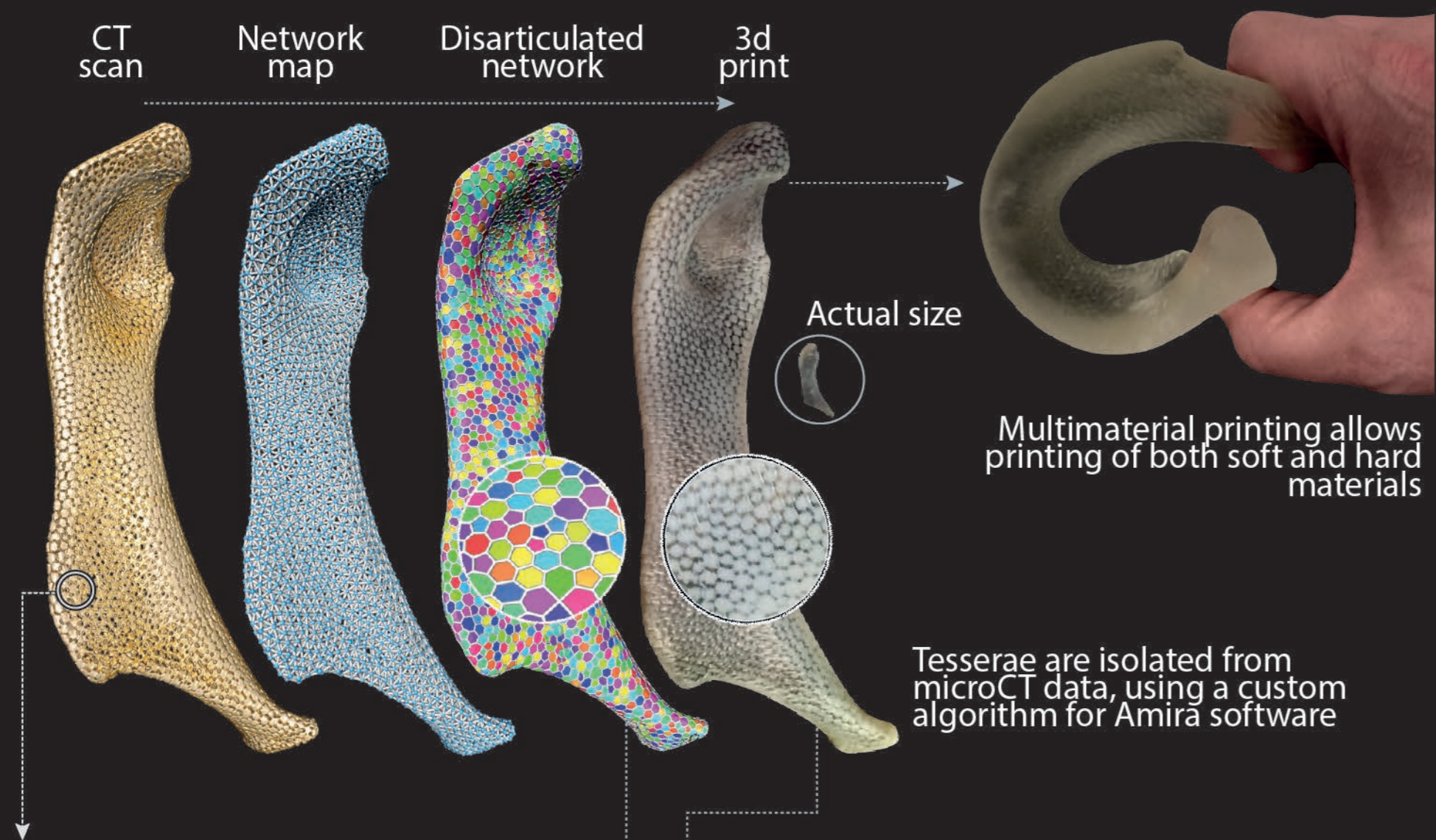


Introduction. Sharks and rays (elasmobranchs) exhibit a peculiar mix of skeletal and dental tissues and anatomies that distinguish them from other animals, containing skeletons of cartilage rather than bone and having teeth that are continuously replaced throughout life. Since cartilage cannot repair, the elasmobranch dento-skeletal system is effectively the opposite of ours —where the skeleton can renew itself and the teeth last a lifetime— and therefore represents a model for investigating alternative biological strategies for fatigue and wear avoidance in high-performing systems. We characterize the tissues, morphologies and interactions of the individual component parts of the dento-skeletal system in two model stingray species, using high-resolution materials characterization and imaging techniques.

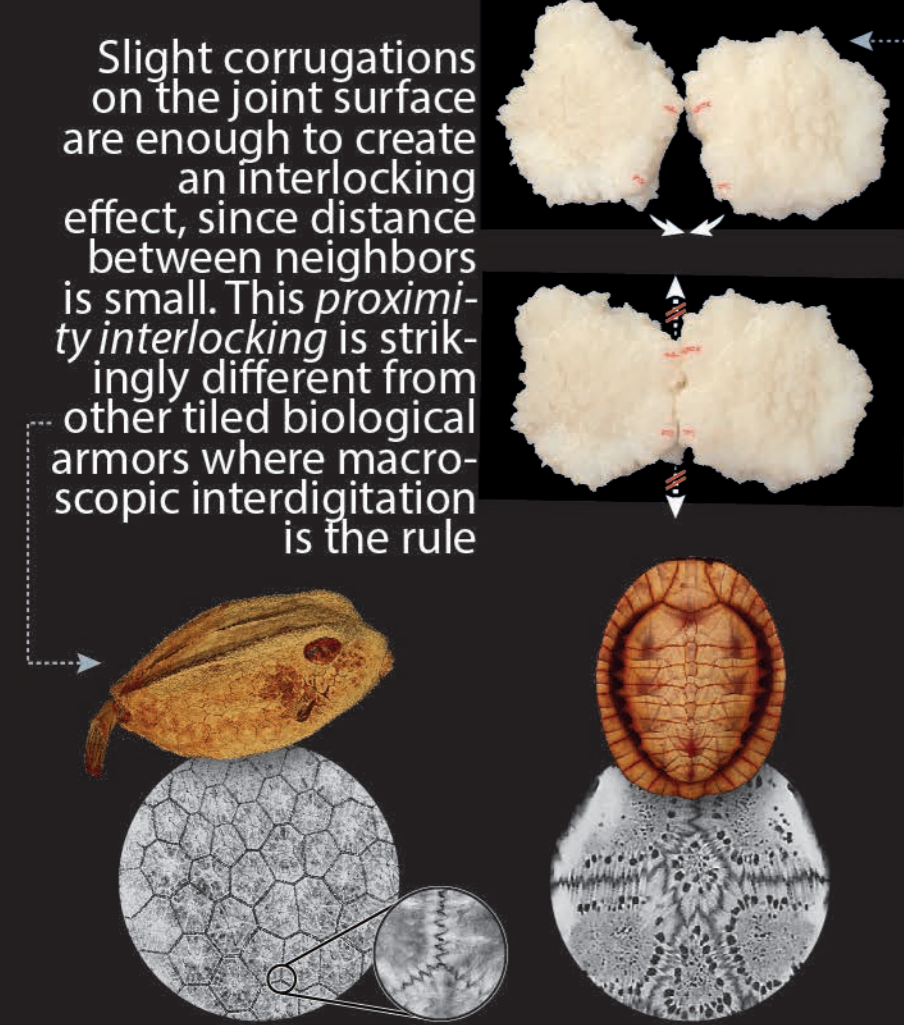
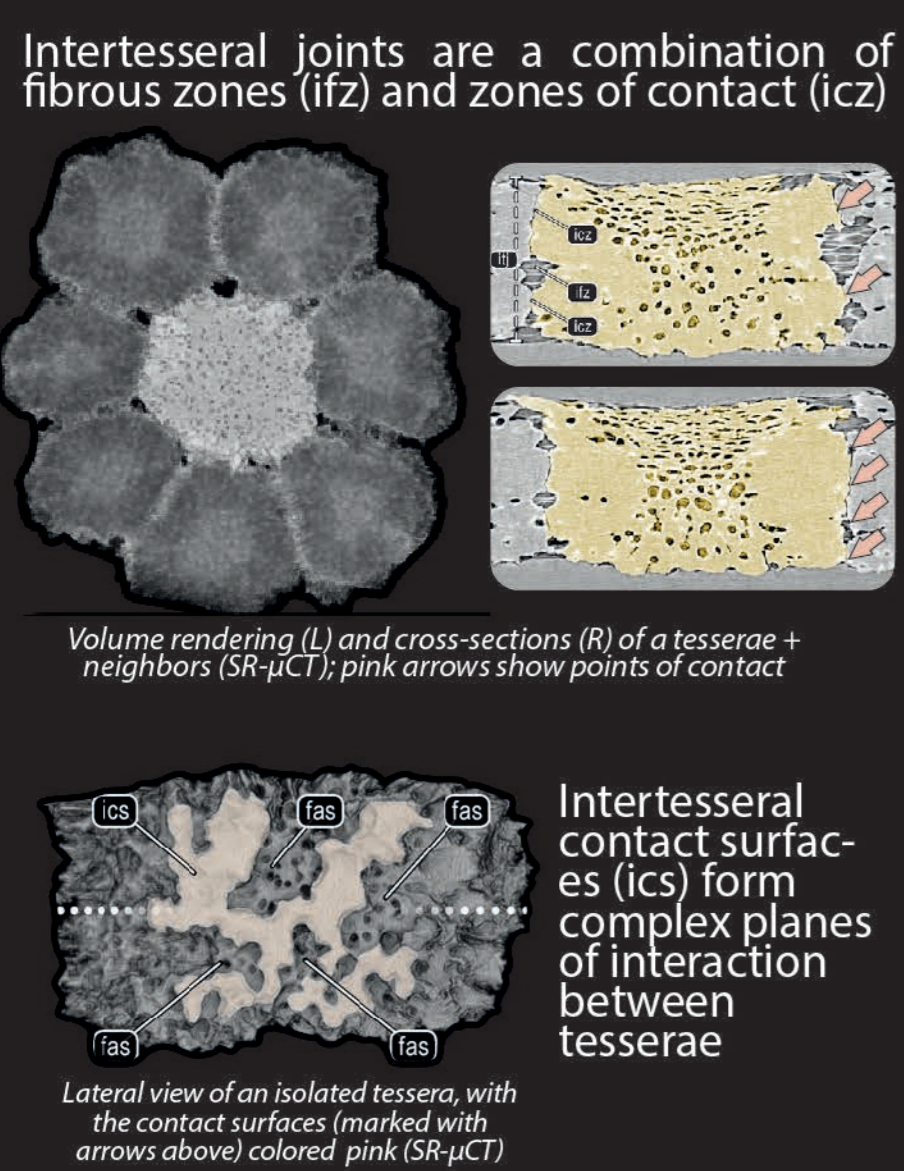
Skeleton



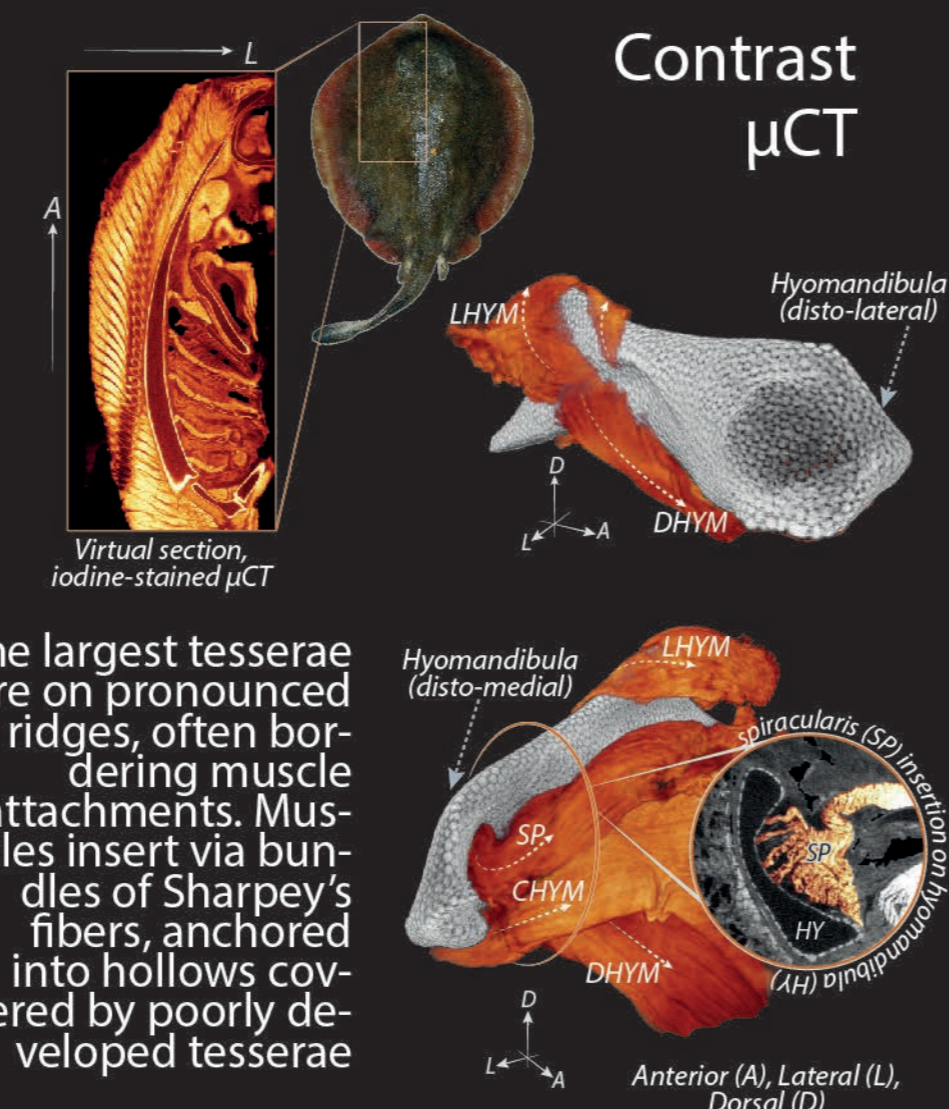
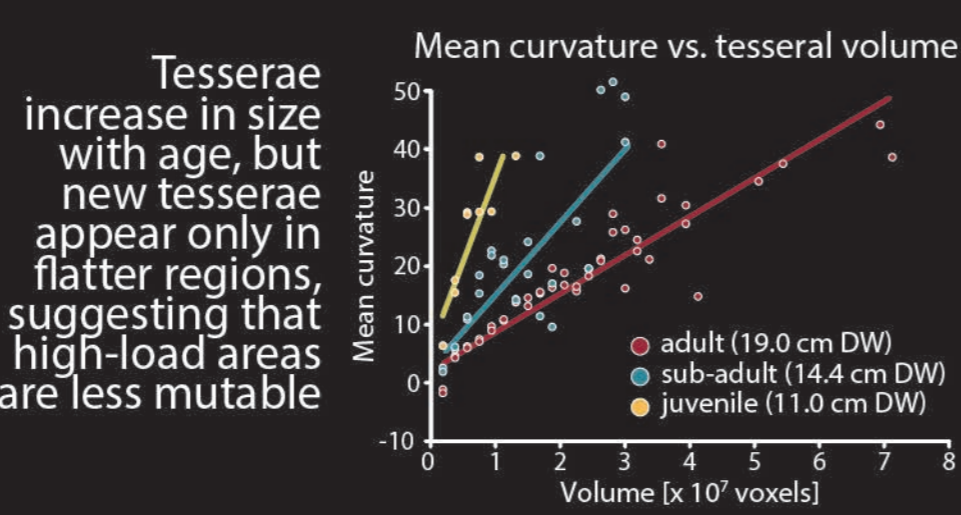
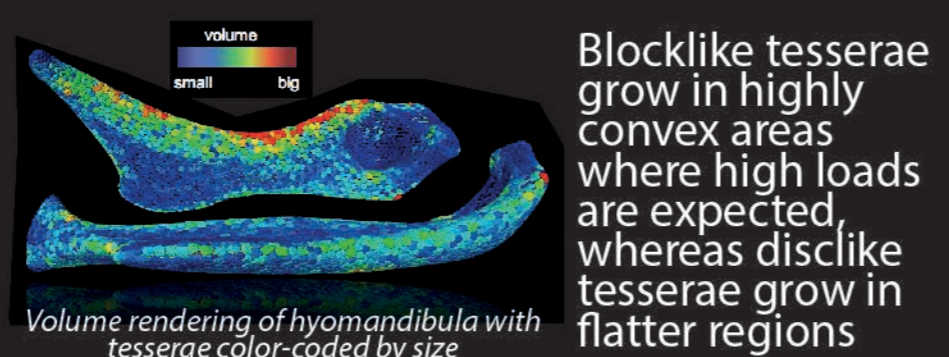
What are the tiling laws and how do these relate to mechanics?



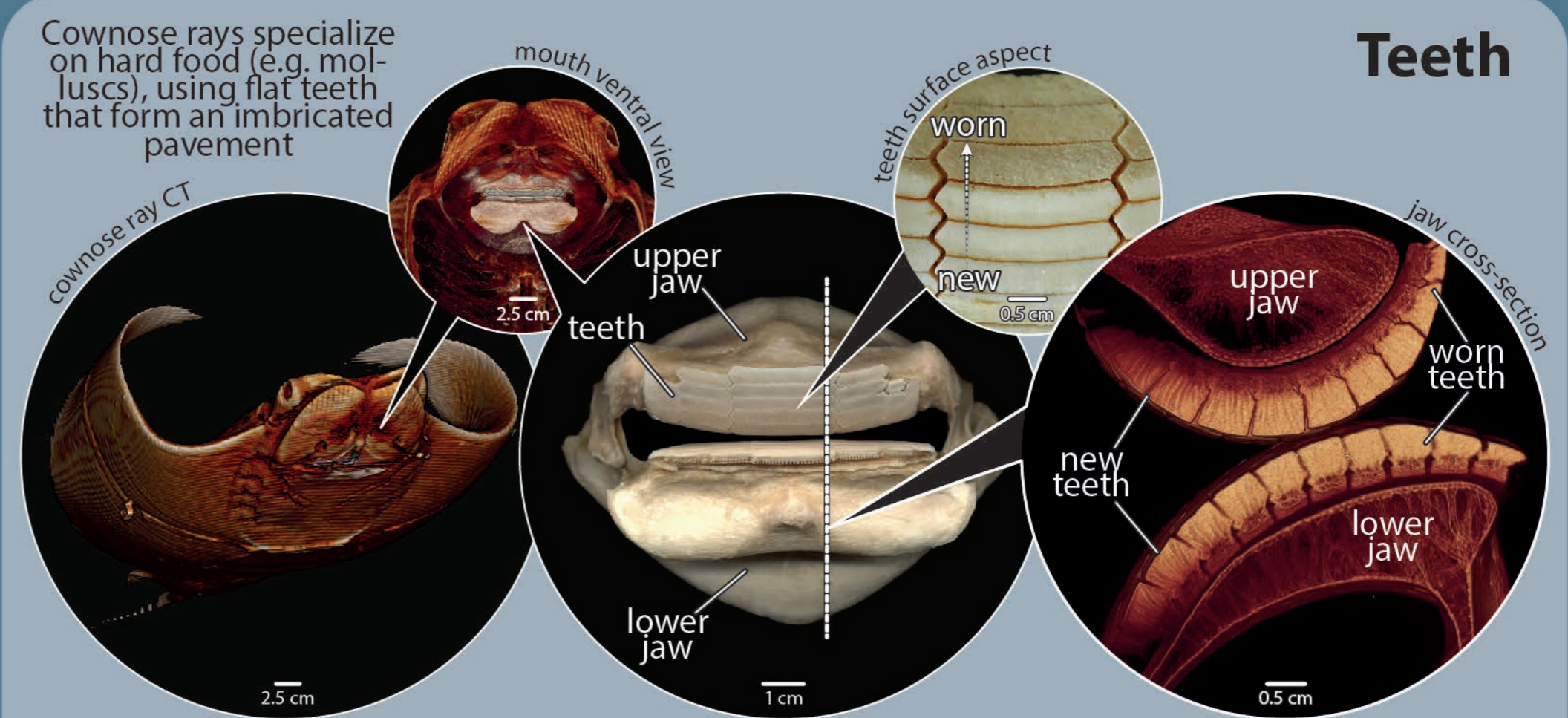
Joint form+function



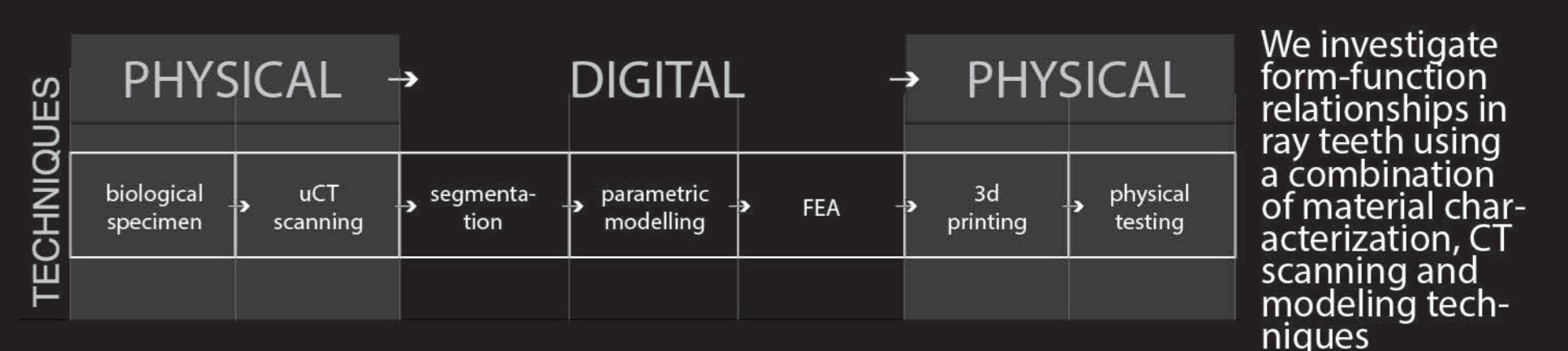
Tesserae and their relationships across an age series of stingrays were quantified



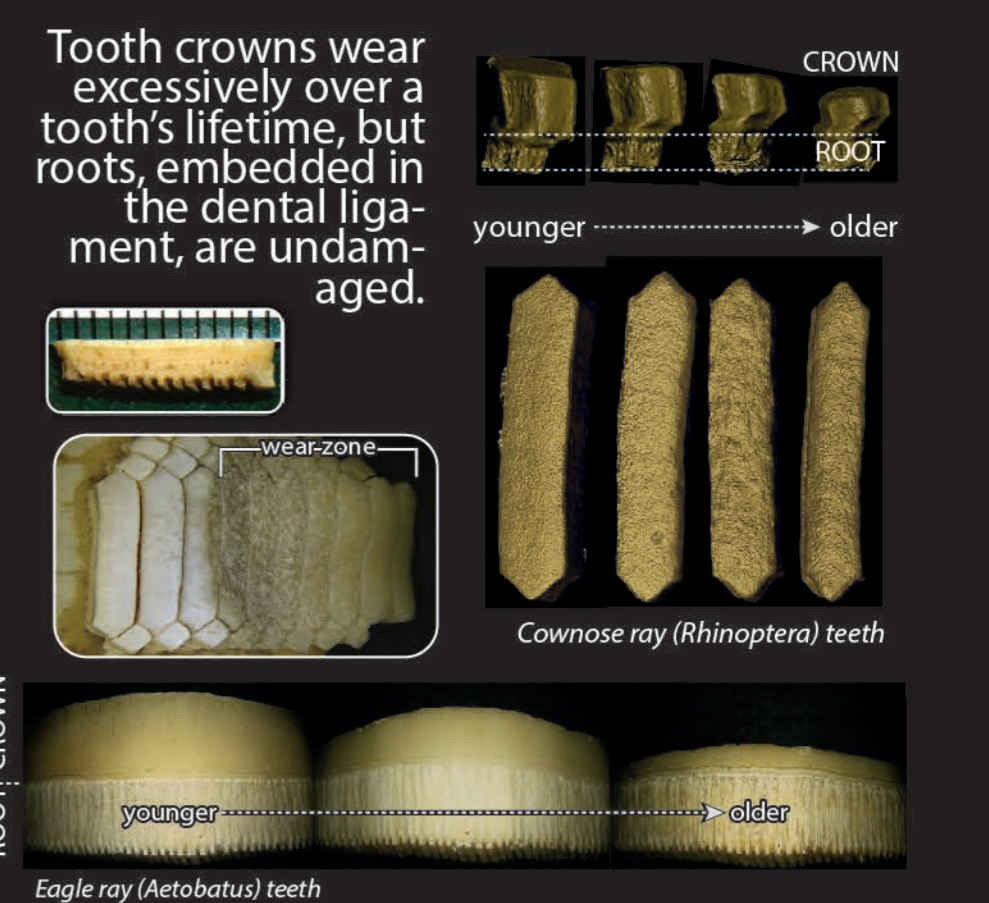
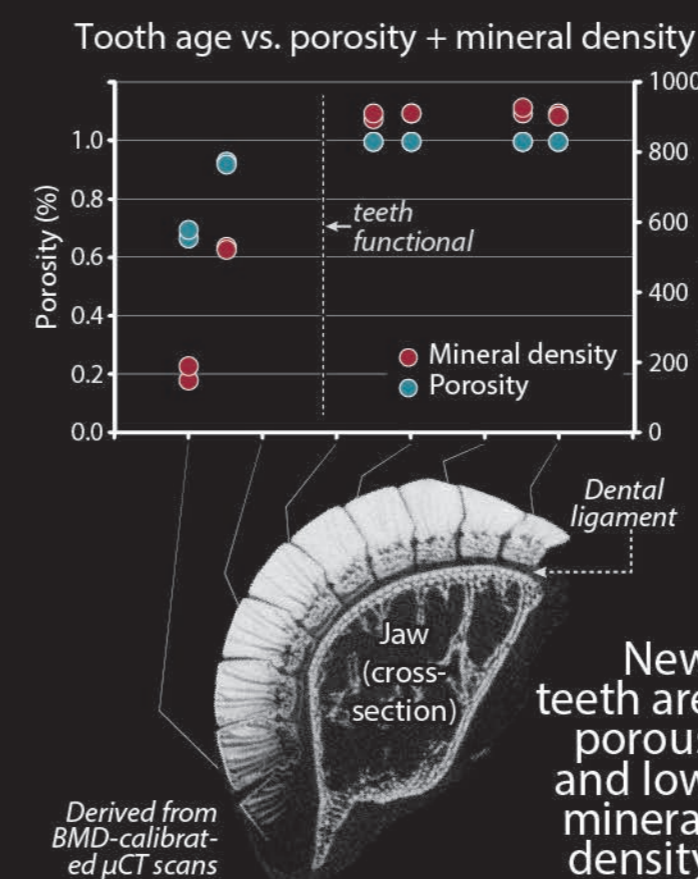
Teeth



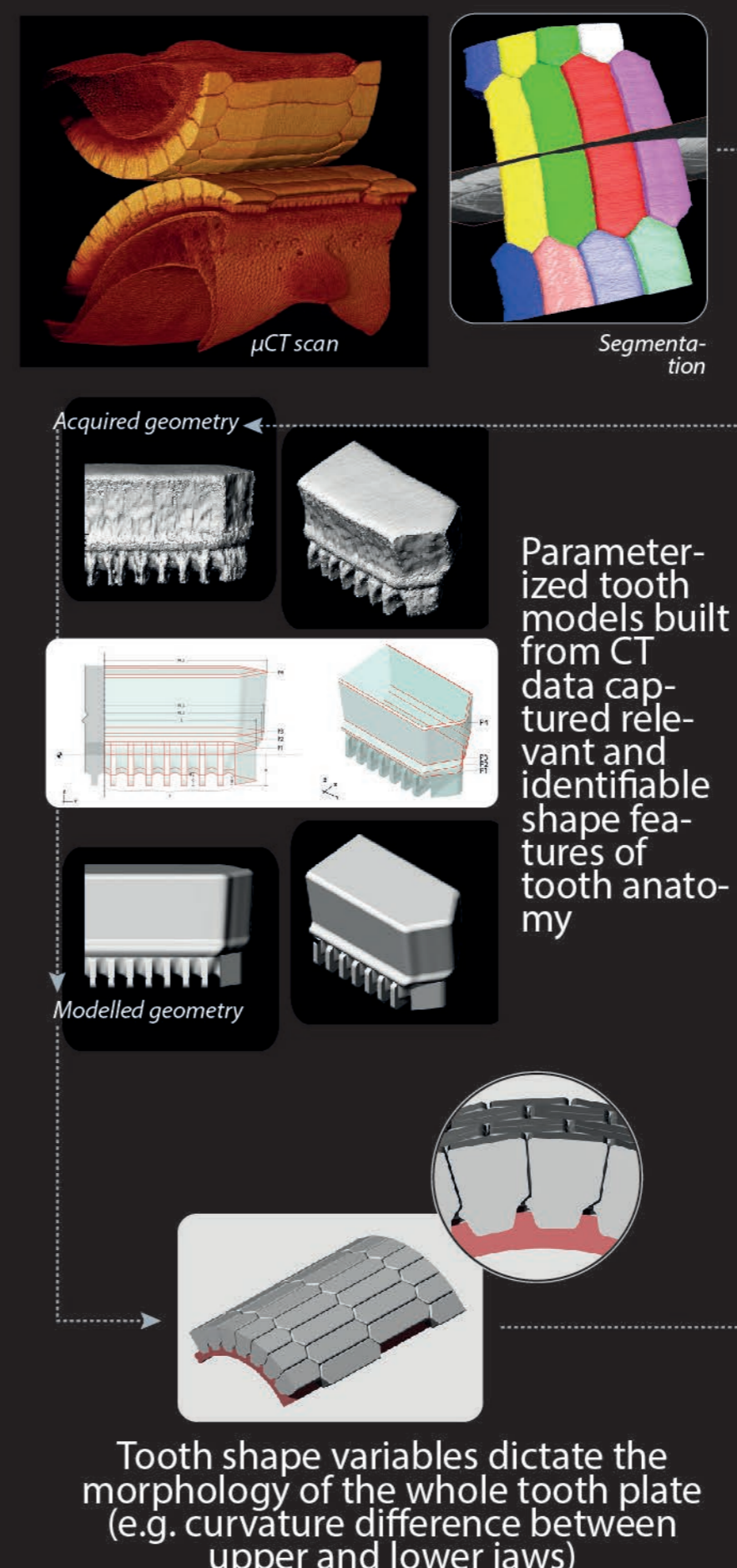
Do wear and tooth-tooth interactions play roles in performance?



Tooth ontogeny+wear



Parameterized modeling



3d printing

