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ABSTRACT:

Over time, so-called classic biological studies (such as anatomical studies) have evolved into modern, highly integrated strategies tackling important questions in evolutionary biology. Where early morphologists limited themselves to descriptions based on dissections, non-invasive imaging techniques nowadays allow to uncover details of anatomy in a way that morphologists can go far beyond basic and descriptive anatomy, e.g. through modelling. In this presentation, an overview is presented on some on-going research projects that rely on X-ray tomography data, which focus on the adaptive evolution of musculoskeletal systems in different vertebrate lineages. Cases discussed are (1) a study on the cranial anatomical diversity and functional implications in the feeding apparatus in seahorses, (2) as well as multi-body modelling of the tail system in these fishes; and (3) structural diversity in Darwin's finches in relation to high performance seed cracking. These cases clearly show the (still not fully explored) potential for testing specific hypotheses with respect to adaptive evolution, where X-ray tomography provides the tools to model experimental conditions that are impossible to achieve with live specimens (e.g. perfect control of specific parameters).