The lagomorph (rabbits, hares, and pikas) skull exhibits a unique set of characteristics that distinguish it from most other mammals. Hares and rabbits hop, and some species show a level of cursoriality that is unmatched for animals of their size. Previous workers have suggested that hare skull morphology is related to locomotion, but this hypothesis has not been thoroughly tested. We explored the relationship between skull shape and ecology using an 2D morphometric data set that included 144 skulls from 17 living leporids (rabbits and hares). Our analyses showed strong correlation of skull shape and burrowing behavior. We also found that the tilt of the facial region relative to the basicranium correlated with locomotion, with generalized scampering taxa having flatter skulls and hoppers having more facial tilt. This led us to investigate possible modularity within leporid skulls. Our 2D data showed that diastema length was more strongly correlated with overall skull length than was basiocipital length. To explore this further we utilized the RV coefficient to analyze a subset of skulls using 3D geometric morphometric data taken from surface renders from CT scans. These analyses suggest a distinct pattern of modularity between the facial and basiocipital regions in the lagomorph skull. The most recent ancestors of lagomorphs, the mimotonids (ca 55Ma), exhibit a facial region that is remarkably similar to that of living lagomorphs, but a relatively primitive basicranium. It wasn’t until tens of millions of years later that the basicranium of fossil lagomorphs showed features that were consistent with those of the highly tilted skulls of living lagomorphs.