omnivorous *Sceloporus magister* and the herbivorous *Iguana iguana* provided the basis for the extant comparative sample. The insectivorous *Ctenosaura hemilopha* and *C. pectinata* were also dissected for further comparison. A suite of skull structures and muscle locations were identified that appear to relate to differences in feeding styles in these extant iguanians. In the omnivorous and insectivorous forms, similarities include the oblique shift of the temporal fenestrae in relation to each other and the long axis of the skull, the dorsal shift of the supratemporal fenestra, and the overall lengthening of the jaw muscles. Alternatively, in the herbivorous *Iguana*, features include the relationship of the temporal fenestrae at right angles to each other and the long axis of the skull, the larger surface area of the parietal bone in the supratemporal fenestra, and the laterally located jaw muscles. These features are also found in the early sauropodomorphs under study. The skull of *P. engelhardti* exhibits temporal fenestrae that are located at a right angle with respect to each other and the long axis of the skull, like that of *I. iguana*, whereas *A. polyzelus* has temporal fenestrae that are of an oblique relationship, similar to that of *S. magister*. Therefore, it is suggested that *Anchisaurus* had a facultative omnivorous feeding style whereas *Plateosaurus* was predominately herbivorous. This study presents the likelihood of a dual origin of herbivory in Sauropodomorpha, as anchisaurids are thought to be phylogenetically more derived than plateosaurids, therefore further elucidating the evolution of herbivory in the derived sauropod dinosaurs.

Poster Session IV (Saturday, November 2, 2013, 4:15 - 6:15 PM)

THE PLUMAGE OF *CONFUCIUSORNIS*: PRIMITIVE OR MODERN?

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The Lower Cretaceous Jehol Group of northeastern China has yielded fantastic fossils of primitive birds. *Confuciusornis*, the most basal beaked bird, is the most numerous fossil bird in the Jehol Group. The osteology of *Confuciusornis* has been extensively defined; however, the structure, positioning, and nature of the feathers remains largely unstudied. *Confuciusornis* does not have a tail fan as do modern birds; many specimens preserve two very long tail feathers. These tail feathers have a unique morphology and have been interpreted as (1) featureless ribbon-like structures with barbs on the distal end, (2) a large rachis with distal barbs, (3) undivided modified pennaceous feathers, and (4) feathers encased in an elongate, persistent feather sheath. These types of feathers have not been found in modern bird lineages, and are dissimilar from modified feathers in the mot-mots (Momotidae), birds of paradise (Paradisaeidae), and nightjars (Caprimulgiformes). Mot-mots and nightjars have modified flight and tail feathers that consist of barbs with weakened bases that are preened away, whereas Birds of Paradise have featureless, ribbonlike feathers. There is no evidence of these modified barbs in the tail feathers of *Confuciusornis*, nor is the proximal part featureless and ribbonlike. *Confuciusornis* has exceptionally long primary feathers, and there is evidence for a fully modern arrangement of these flight feathers. There are 10 primary feathers on the hand. The 10th (outermost) primary is significantly shorter than the 9th primary, however, in the specimens examined there is no evidence of an alula. The rachis in the primary feathers is large and robust (~1–1.5 mm wide), contrary to what has been reported previously for confuciusornithids. The secondary feathers contact the ulna, but in the specimens examined they are folded and cannot be counted. The primaries and secondaries are partially covered by greater primary and secondary coverts. The primary feathers appear to overlap flattened portions of the proximal phalanx and carpometacarpus, as in modern birds. Primary feathers 5–10 appear to abut the proximal phalanx, whereas 1–4 likely abut the carpometacarpus; however, in most specimens the carpometacarpus and the proximal rachises are not visible. Barbules are preserved on some of the primary feathers. There is also significant evidence of a crest based on the feathers of the head.

Technical Session XIV (Saturday, November 2, 2013, 8:00 AM)

USING AVIAN SUBSURFACE 3D FOOT MOTION TO SIMULATE FOSSIL TRACK DIVERSITY

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The fossil track record is our primary window on the locomotor capabilities and behaviors of extinct animals, yet the variation seen among footprints is daunting, both at the assemblage level, and even within trackways made by a single individual. In order to make solid inferences about the trackmaker, locomotion, or behavior, we must understand how pedal anatomy, distal limb kinematics, and substrate interact to generate track morphology.

Our aim was to begin to decouple this complex system by simulating tracks of different depth while holding foot structure and motion constant. We first analyzed a chicken-like bird, the helmeted guineafowl, traversing a bed of poppy seeds using X-ray Reconstruction of Moving Morphology (XROMM) to reconstruct the 3D kinematics of the distal limb both above and below the surface of the compliant substrate. We then imported these 3D kinematics into computer simulations of granular material, carried out using the Discrete Element Method (DEM).

Changes in depth alone produce a wide diversity of resultant tracks, both at the exposed surface and at intermediate levels. The shallow angle of the metatarsus and digits at entry and exit cause elongation of the surface morphology as the foot sinks deeper. Backwards motion of the distal phalanges at toe-off results in parallel scratch marks at the base of the track.

The variation seen in these simulated tracks bears striking resemblance to many of the tracks in the Hitchcock collection, held at the Beneski Museum of Natural History, Amherst. Our kinematic data and simulations suggest much of this variation stems from the depth to which the foot sank and to the level subsequently exposed, rather than from a diversity of foot morphologies or locomotor kinematics. We also show that the subsurface foot motion associated with traversing a compliant substrate can produce tracks (or portions of tracks) which may, if interpreted without complete context, be attributed to unusual behaviors such as swimming.

Technical Session II (Wednesday, October 30, 2013, 9:45 AM)

FRACTAL DIMENSIONALITY AS A MEASURE OF OCCLUSAL ENAMEL COMPLEXITY IN EQUIDAE (MAMMALIA: PERISSODACTYLA)

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Enamel patterns on the occlusal surfaces of equid teeth are asserted to have tribal-level differences. The most notable example compares the Equini and Hipparionini, where Equini have higher crowned teeth with less enamel-band complexity and less total occlusal enamel than Hipparionini. While previous work has successfully quantified differences in enamel band shape by dividing the length of enamel band by the square root of the tooth surface area (Occlusal Enamel Index, OEI), we have discovered that OEI only partially removes the effect of body size. Because enamel band length scales allometrically, body size still has an influence on OEI, with larger individuals having relatively longer enamel bands than smaller individuals. Fractal dimensionality (*D*) can be scaled to any level, so we have used it to quantify occlusal enamel complexity while completely eliminating the effects of scaling from body size. With the effects of body size removed, we can now directly investigate complexity. To test the hypothesis of tribal-level complexity differences between Equini and Hipparionini, we digitally traced a sample of 20 teeth, ten from each tribe. We restricted our sampling to the P3 to eliminate the effect of tooth position. After calculating the *D* of these teeth with the fractal box method, we performed a nested two-way analysis of co-variance (ANCOVA) with taxonomy (tribe, genus, and species) as a nested independent factor, true occlusal area (a proxy for body size) as a continuous independent factor, and *D* as the dependent factor. The ANCOVA indicates that genus nested within tribe (p=0.0428), and species nested within genus and tribe (p=0.0148) are significant. True occlusal surface area (p=0.4116) and tribe (p=0.0666) are not significant. Our preliminary results suggest that, as expected, fractal complexity is independent of body size. The tribal level was not significantly different for complexity and the significance of the lower taxonomic levels suggests that complexity is the product of speciation and behavior rather than taxonomy.

Technical Session III (Wednesday, October 30, 2013, 3:00 PM)

BIOGEOGRAPHY OF BASAL NEOCERATOPSIAN DINOSAURS ILLUMINATED BY A SKULL FROM THE CLOVERLY FORMATION (LOWER CRETACEOUS) OF MONTANA

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Basal neoceratopsians have been previously reported from the Early Cretaceous of North America based on postcrania and isolated teeth, but the incompleteness of these fossils has hampered meaningful broader interpretation. The skull of a small basal neoceratopsian from the Cloverly Formation of Carbon County, Montana, provides clarification of the phylogenetic and biogeographic relationships of Asian and North American neoceratopsians. The specimen was collected from the basal portion of Unit VII of the formation; we provisionally regard it as Albian in age. The skull measures 84 mm from the tip of the rostral to the tip of the jugal, representing a small (possibly immature) animal. Definitive ceratopsian synapomorphies include a rostral bone, among others. The three premaxillary teeth lack denticles, and only the labial surfaces of the 10 maxillary teeth possess enamel. Each tooth crown shows a distally-placed primary ridge with at least one accessory ridge on each side, as in *Archaeoceratops*. Similar to *Archaeoceratops* and coronosaurs, the predentary tapers to a sharp point. The jugal is prominent but lacks an epijugal, as in *Liaoceratops* and non-neoceratopsians. Phylogenetic analysis places the Cloverly ceratopsian within Neoceratopsia, close to *Liaoceratops* and the origin of the clade. Somewhat surprisingly, the Cloverly taxon is not closely related to later North American ceratopsians. Dispersal Vicariance Analysis and the Dispersal-Extinction-Cladogenesis model were used to reconstruct ancestral ranges within Ceratopsia. In agreement with previous hypotheses, the earliest ceratopsians are reconstructed as Asian; dispersal into North America during the Early Cretaceous is required to account for the Cloverly taxon. As many as two subsequent and separate dispersals are required to account for later North American ceratopsoids and leptoceratopsids. The Cloverly ceratopsian provides additional evidence for a faunal connection between North America and Asia by the mid-Albian or perhaps even earlier.

Poster Session II (Thursday, October 31, 2013, 4:15 - 6:15 PM)

A PHOTOGRAMMETRIC RECREATION OF ROLAND T. BIRD'S PALUXY RIVER THEROPOD-SAUROPOD "CHASE SEQUENCE" TRACKSITE QUARRY (GLEN ROSE FORMATION, LOWER CRETACEOUS, DINOSAUR VALLEY STATE PARK, SOMERVELL COUNTY, TEXAS)

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In 1940 R.T. Bird of the American Museum of Natural History (AMNH) exposed a sequence of footprints of a sauropod and an associated theropod dinosaur in the dolomitic mudstone bed of the Paluxy River. Portions of the two trackways were cut into pieces from the river bed, and later reassembled at the AMNH and the Texas Memorial Museum (TMM) in Austin. Bird took an extensive series of overlapping photographs along the length of the two trackways. We digitized these images, and used photogrammetric software to combine them into a model that can be viewed from any perspective, digitally