In this issue . . .

Human impacts and Bahamian birds

Humans arrived in the Bahamas 1,000 years ago, and prehistoric climate shifts have altered habitats, especially the transition from the relatively cool and dry Pleistocene to the current warm and wet Holocene. However, the influence of such factors on the biodiversity of the islands' bird species is unclear. David Steadman and Janet Franklin (pp. 26833–26841) report that 69% of landbird species in the Pleistocene fossil record have currently different distributions. The authors charted species composition over time in four fossil sites across four islands in the Bahamian Archipelago. Out of the 90 species identified in the fossil sites, 62 species are either locally extinct and no longer found on that particular island or globally extinct. Species losses were distributed across habitats and feeding types, including insectivores and scavengers, though more species were lost from the pine and broadleaf forests during the period of rising sea levels and the transition from the Pleistocene to the Holocene. According to the authors, the factors that likely fueled these extinctions, including increasing storm severity and human expansion, are currently in play, leaving bird populations at risk. — T.H.D.

Aerial view of dense, broadleaf, seasonally dry forest, a widespread habitat in the Bahamian Archipelago in the Wilson City area of Abaco Island, The Bahamas.

Applying information theory to landscape art

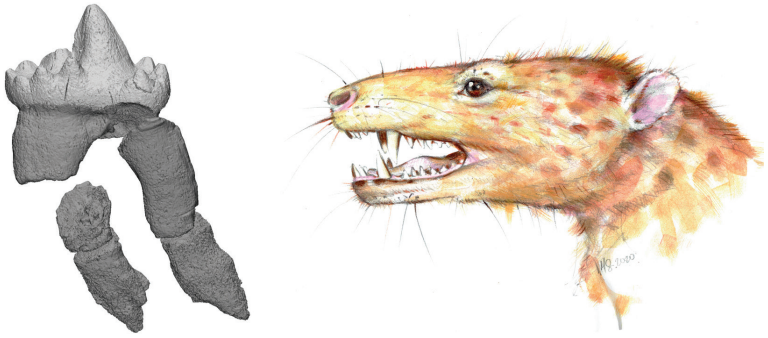
Works of art are typically described in qualitative terms rather than systematically analyzed with mathematical methods. Byunghwee Lee, Min Kyung Seo, et al. (pp. 26580–26590) used information theory to characterize the spatial composition of 14,912 digitally scanned Western paintings made over a 500-year period. An algorithm segmented paintings vertically and horizontally in sequential steps, from the most prominent to the least informative compositional features. Horizontal partitions outlined the sky, earth, and atmospheric color changes, whereas vertical partitions bordered trees, plants, buildings, and cliffs. The authors found that different compositional patterns characterized different artists, artistic styles, and time periods. Approximately 87% of the paintings were segmented horizontally in the first step, and the position of this dominant horizontal

The Lock (1824) by John Constable dissected based on an information-theoretic partitioning algorithm. Image credit: Wikimedia Commons/Museo Thyssen-Bornemisza. Adapted from Constable, John. 1824. *A Boat Passing a Lock*.

dissection shifted over time. Baroque paintings in the 17th century frequently featured dominant horizons below the midline of the painting, with the sky occupying a larger portion of the canvas. By contrast, the dominant horizons were located near the midline during the Rococo and Romantic periods, and near the upper one-third of the canvas during the Realism and Impressionism periods and in the 20th century. The approach could be applied to other art forms, such as photography, film typography, and architecture, to reveal macroscopic quantitative properties that may not be readily discernible, according to the authors. — J.W.

Tooth structure of early mammaliaform

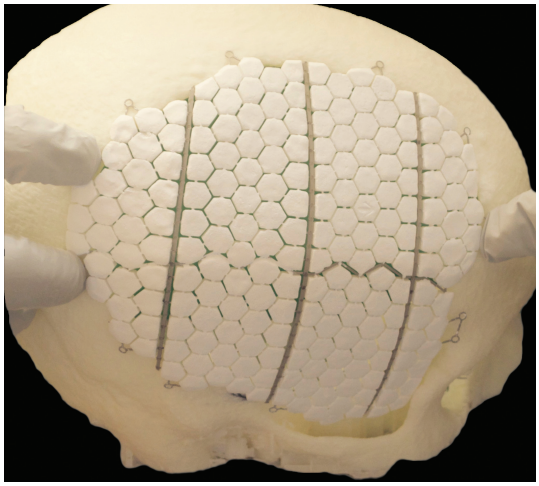
One evolutionary milestone in the development of mammalian teeth can be found in haramiyidan mammaliaforms, which developed double rows of cusps on molar-like teeth adapted for omnivorous feeding. However, the origin of the multicusped pattern is unclear. Tomasz Sulej et al. (pp. 26861–26867) used computerized tomography scanning to analyze the dentary and tooth structure of a recently described mammaliaform species, *Kalaallitkigun jenkinsi*, discovered on the eastern coast of Greenland and dating from the late Triassic. The species exhibits the earliest known mandibular fossil with two rows of cusps on molars and double-rooted teeth. The dentary anatomy and tooth structure place *K. jenkinsi* in an intermediate position between haramiyidans and morganucodontids, although with teeth nearly twice the size of morganucodontids and similar in size to haramiyidans. The species offers insight into mammalian tooth evolution, particularly the development of double-rooted teeth. Biomechanical analysis found that double-rooted teeth are better able to withstand mechanical stresses, including those of upper and lower tooth contact during biting, compared with single-rooted teeth. According to the authors, the results suggest that molar-like teeth with crowns may have developed together with biomechanically optimized dual roots. — P.G.



An artistic reconstruction of a mammaliaform from the Triassic of Greenland (*Right*) and the 3D reconstruction of the molar-like tooth (*Left*). Illustration credit: Marta Szubert (artist).

Bioceramic implants and skull bone regrowth

Repairing cranial defects is a significant challenge because the ideal solution, bone grafts, carries risks for both the donor site and graft. Other synthetic solutions, such as plastic implants, poorly integrate bone and soft tissue. Omar Omar, Thomas Engstrand, et al. (pp. 26660–26671) explored an alternative approach using a 3D-printed bioceramic scaffold implant on a titanium frame to induce bone regrowth. Experiments in sheep showed that architectural and growth-inducing cues in the bioceramic structure promoted bone regeneration, even at locations distant from the host bone. In contrast, implants of titanium alone showed only bone ingrowth from the boundaries of the host bone. The bioceramic itself converted into the bone mineral carbonated apatite, with a molecular composition indistinguishable from native bone. The authors also evaluated a bioceramic implant in a human 21 months after implantation and found that the implant had been converted into well-vascularized bone tissue, with a structure and composition similar to native bone. According to the authors, the results illustrate how synthetic materials can induce bone regeneration and repair large bone defects without the need for bone grafts. — P.G.



Personalized 3D-printed implant with multiple bioceramic tiles adapted to a model of a large skull defect.