vertebral count and the distribution of centrum length and intervertebral flexibility along the neck. The flexibility observed in representative vertebrates is replicated, and implications for sauropod dinosaurs are derived.

The first records of amphibians, lizards and maniraptoran dinosaurs from the Lower Cretaceous Hastings Group of south-east England

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Prior to the 1970s the only small tetrapod remains to be reported from the Berriasian – Valanginian Hastings Group of the Wealden Supergroup of mainland Britain were a tooth and tooth fragment of the multituberculate mammal *Loxaulax valdensis*. Commencing in 1970 a comprehensive search of mainland Wealden Supergroup strata for new mammal remains was undertaken by a team led by Kenneth Kermack. This resulted in the recovery of specimens representing new Mesozoic mammals but no mention was made of any co-occurring small tetrapod taxa. To date the only record of small tetrapods from the Wealden Supergroup of mainland Britain is that of a salamander, frog and lizards from the Hauterivian part of the Weald Clay Group exposed at Keymer Tileworks in West Sussex. However, examination of Mesozoic mammal specimens accessioned in the collections of the Natural History Museum, London, has revealed the existence of an un-catalogued salamander atlas among material obtained by Kermack in the 1970s. More recently, excavations and bulk screening of samples from Valanginian Hastings Group horizons exposed at Ashdown Brickworks near Bexhill, East Sussex, has produced more small tetrapod remains including those of salamanders, a frog, lizards and small theropods including a maniraptoran.

Why giraffes have such short necks

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The necks of sauropod dinosaurs were by far the longest of any animals, exceeding 15m. Four clades with very different cervical morphologies (mamenchisaurids, diplodocids, brachiosaurids, and titanosaurians) evolved 10m necks. By contrast, the neck of the giraffe, the longest of any extant animal, reaches only 2.4m. Those of theropods and pterosaurs attained at most 3m. (Even among aquatic animals, the record is only 7m for elasmosaurs.) Four factors contributed to sauropod neck length: the sheer size of the animals, their distinctive vertebral architecture, air-sacs, and heads that merely gathered food without processing it. Cervical vertebral innovations included: extreme pneumatisation, which lightened the neck and increased bending resistance; elongate cervical ribs, which allowed hypaxial muscles to shift posteriorly; and, in several clades, bifid neural spines, which aided stability by shifting epaxial tension elements laterally. Bifid cervicals evolved at least four times among sauropods and were never secondarily lost; they are otherwise found only in Rhea. However, other aspects of sauropod cervical anatomy remain puzzling: low neural spines reduced the moment arm of epaxial tension members; ventrally displaced cervical ribs increased bulk; and epipophyses were not posteriorly elongated. These apparent flaws suggest our understanding of sauropod neck mechanics remains incomplete.

An adult–egg association and its implications for pterosaur reproductive biology

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An individual of *Darwinopterus* from the Jurassic Tiaojishan Formation of China, preserved in direct association with an egg, provides critical new insights into the reproductive biology of pterosaurs. The presence of a cranial crest in some individuals of Darwinopterus, but its absence in the new find, evidently a female, provides the clearest support yet for the hypothesis that these structures, widespread in pterosaurs, are sexually dimorphic. Although the new find shows some evidence of osteological maturity it is significantly smaller than other mature individuals of *Darwinopterus* suggesting that, as in extant reptiles, sexual maturity preceded final adult size. The egg, preserved immediately posterior to the pelvis, is oval, seemingly soft shelled and relatively small compared to the adult. Preliminary estimates of egg/adult mass are similar to those of reptiles, notably squamates, and less than half the value for adult birds of