Feathered or furry dinosaurs?

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Soft tissue preservation

For several years, reports have been accumulating of dinosaur discoveries with exceptional soft tissue preservation.[1,2] Usually, one only finds remnants of hard tissue such as mineralized bone, teeth and eggshells, in addition to petrified footprints, and very occasionally, detailed skin impressions.

What is not widely known is that discoveries of dinosaurs with preserved soft tissue were already documented around the beginning of last century.[3] At the time, however, experts did not show much interest. Due to ignorance, improper handling of samples and time restriction, any potential soft tissue was removed to allow faster access to the precious bones.

With the discovery of numerous dinosaur graveyards in China and Mongolia since the 1970s, there has been an increase in the number of dinosaur remains found with so-called skin and feather impressions as well as remnants of other soft tissue. Other sites with exceptionally well preserved dinosaur specimens are also known in Italy and USA. Of special mention are the discoveries of remnants of lung and heart tissue.[2] These remnants, and the so-called dermal structures, are especially interesting, since they are meant to be proof for the warm-blooded theory of dinosaurs and for the belief that dinosaurs are the ancestors of birds.

Dermal structures

To date, dermal structures have been described for specimens from six dinosaur groups.[4] However, there is no consensus among paleontologists about the exact composition of these filamentous elements. They are believed to be either featherlike, comparable with today's bristle or filamentous feathers, or hair-like structures. But depending on the background and bias of the scientists involved in their study, these filaments are considered to be either real feathers[5,6]—in other words, evidence for a direct relationship to birds—or structures that make up the dense hair-covering of flying reptiles and mammals.[7] Especially interesting is the fact that these filamentous elements have not only been found in theropods (meat-eating dinosaurs), which are commonly held to be the ancestors of birds, but they also occur in the psittacosaurs. Psittacosaurs were presumably strictly herbivorous, parrot-beaked dinosaurs about 2 m long, which have been placed close to the ceratopsians (horned dinosaurs). The presence of dermal structures in these two varied groups of dinosaurs reduces the force of the argument that the 'feather cover' of theropods shows their ancestry to birds.

Based on the present illustrations and descriptions of these dermal structures, the following can be concluded:

1. The filaments have a predominantly long and unbranched shaft.
2. It is not clear whether the original filaments had lightly ramified tips or if this is an artefact of preservation.
3. Clear-cut feather types such as contour and secondary flight feathers, or down feathers are either missing to date or have only been described in groups that are systematically placed among birds, such as Archaeopterygidae (e.g. *Archaeopteryx*), Confuciusornithidae (e.g. *Confuciusornis*), and Enantiornithes ('opposite birds').
4. The dermal structures of dinosaurs are strongly reminiscent of the hair-like formations of extinct flying reptiles.
5. From a uniformitarian point of view, all types of dinosaurs with this special type of skin covering are younger than the famous 'primeval' bird *Archaeopteryx* discovered in Bavaria, Germany. For this reason, we can discard the idea that they are ancestors of birds.

Conclusion

Nothing is known about the skin of the majority of the nearly 500 dinosaurs described to this day. A few had scales similar to that of reptiles. Some small and mid sized dinosaurs, of up to 2 m in length, apparently had a hair-like coat on some parts of their body and at their extremities. To what extent these dermal structures resemble the hair of mammals is not known, but our current understanding does not support the existence of feathered dinosaurs. While alleged feathers on dinosaurs are commonly claimed to be proof of the dinosaur-to-bird theory, the reality is often the other way round. I.e., the dinosaur-to-bird theory is a presupposition by many of its adherents, and the assumed truth of this is used as 'proof' of the feather identification! Clearly this is circular reasoning.

References

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