Samotherium fossils and variation in the neck within the giraffe kind (Giraffidae)

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Popular level summaries of scientific research often use catchy headlines and phrases to capture the reader's attention, even if they are a bit misleading. Recently a summary claimed: "Fossil bones from extinct cousin reveal how giraffe got its long neck" and that "It has long been thought that the giraffe's neck was a result of evolution, but fossil evidence had been lacking."[1] The fossils don't really tell us how the giraffe got its long neck, but the scientific study referred to does provide important information on how cervical vertebrae vary within the family Giraffidae. Since the giraffe, okapi, and bones from extinct members of this family are considered by creationists to belong to creatures from a single created kind, the types of differences identified are welcome information to help us understand how God designed creatures of this kind to vary.[2]

Skeletal variation is common in mammals, even within a single species. In domestic pigs the number of thoracic and lumbar vertebrae can vary, and the underlying genetic basis of this variation is being uncovered.[3] Yet it is far more common for the size and shape of vertebrae to vary. For example, variation in the vertebral processes of the cervical spine in horses has been described. In one case the variation was correlated to breed; in another it was correlated with the sex of the horse.[4] Also, some sheep (e.g. the Nubian breed) have large (interarcual) spaces between several cervical vertebrae.[5]

The long-necked giraffe

Despite its incredibly long neck, the giraffe has the same number of cervical vertebrae (seven) as nearly all other mammals.[6] The increase in length is primarily due to an increased rate of growth in that dimension of all its cervical vertebrae, most of which takes place after birth.[7] These neck bones make up half the total length of the spinal column by the time the giraffe is full grown. There is some restructuring that appears in various regions of the spinal column too. The first thoracic vertebra bears similarities to the last cervical vertebra in other species. Additionally, the transverse processes are enlarged to support the modified muscles that support the neck.[8]

The only two species of the giraffe family that are alive today, the giraffe and the okapi, are on opposite ends of the spectrum when it comes to neck length. Based on fossil evidence it is suggested that the giraffe had an ancestor with a much shorter neck.[9] The study highlighted by the popular level news release involved detailed study of fossil cervical vertebrae from *Samotherium major*, 'an intermediate-necked giraffid', and comparison of the measurements to those from the giraffe and okapi.[10]

Holding the head up high

The authors address the position the neck is held at in the resting animal as it relates to the shape of the vertebrae and features of the skull. In some ruminants the head is held relatively horizontal, with the first cervical vertebrae (atlas, or C1) nearly the same level as the last (C7). This is seen in animals such as cattle and African buffalo. A semi-vertical position, where the cervical vertebrae are held around a 45° incline, is seen in the okapi and various species of gazelle. A more vertical position, with a greater than 60° incline in the resting animal, is seen in the gerenuk (a long-necked species of antelope) and the giraffe. Skeletal features of *S. major* seem to be most similar to the latter based on certain features of C1, C7 and the position of the palatine indentation (figure 1). Thus they conclude that *S. major* held its neck in a vertical position.

There are other anatomical findings in *S. major* that are uncharacteristic of ruminants, namely a wedge shape of the cervical vertebrae as viewed from the side. Several muscles from the thorax insert in the caudal region of the cervical vertebrae, and the authors believe these regions are thicker in *S. major* to allow for a broader attachment. They feel this further supports their inference of a vertical position of the neck. *S. major* has other features not seen in either the giraffe or okapi. For example there are differences in the position of spinous process on C2 that may have allowed for more dorsal flexion of the head.

Samotherium, fitting in between

In the upper region of the spine (C2–C3; see figure 1) *S. major* has features that were a mosaic of okapi and giraffe characteristics. For example, the angle of the dorsal tubercle was similar to the okapi, while the angle of the spinous process was more similar to the giraffe. This pattern was seen for a number of other measurements in this region. In contrast, the more caudal cervical vertebrae (C5–C7) tended to be intermediate between the extant species.

The authors discuss a previous study where it was found that the cranial region of vertebrae were lengthened in fossils believed to be

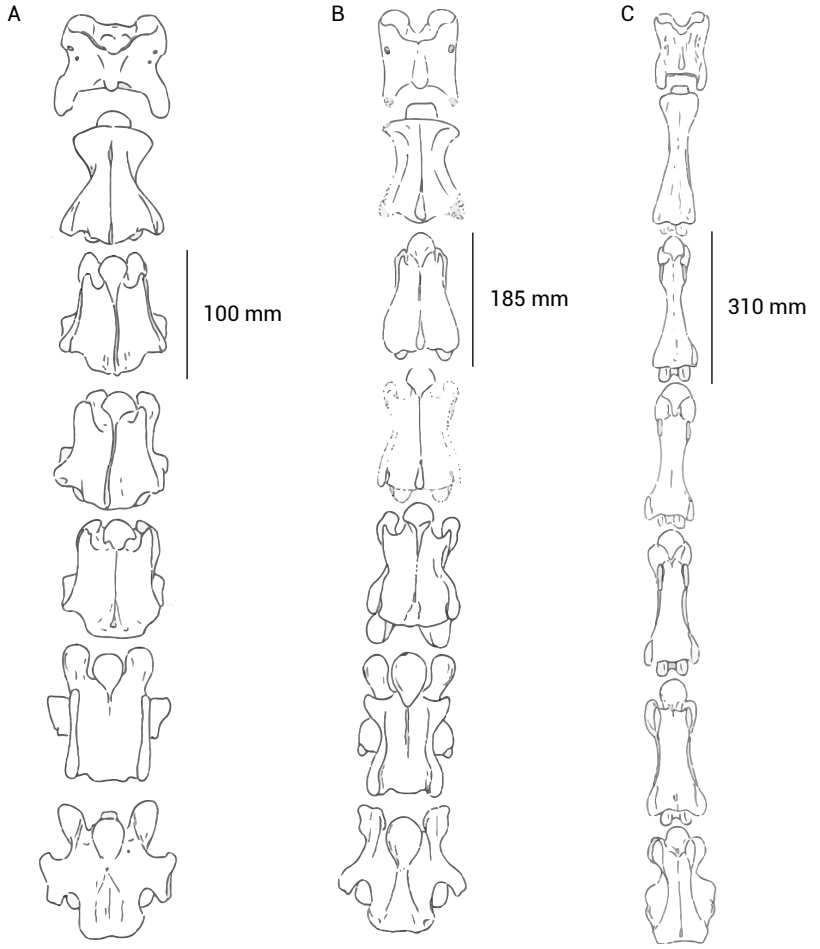

Figure 1. C1–C7 vertebrae (from top to bottom) of *(a) Okapia johnstoni, (b) Samotherium major,* and *(c) Giraffa camelopardalis* (figure 7 from Danowitz, Domalski, and Solounias[10]).

from giraffids with an intermediate neck length. The giraffe has lengthening in both the cranial and caudal aspects of its vertebrae. So in this characteristic, *S. major* is believed to have undergone the first of two steps in neck lengthening, lengthening of the cranial portion of the cervical vertebrae.

While *S. major* is not considered a direct ancestor of the giraffe, it is exceptional in that an almost complete neck has been found. From the comparisons that have been made we can see that changes in neck length are complex and not just a matter of scaling. The extra length has implications for muscle attachments to adjust for the stress (extra weight with an increased moment arm) and changes in head carriage. Other body systems must adjust as well.[11]

Conclusion

Evolution is often defined as change over time. Thus, evolutionists often point to changes within created kinds and claim it is evidence for evolution, the idea that all animals share common ancestry. In the case of the giraffe family, there certainly have been changes. However, they do not support universal common ancestry. Within kind changes require that there is design to allow for the body to change without destroying the animal. Changes in size, shape, and even number of vertebrae require both an animal designed with these skeletal features as well as design in the animal to allow for changes (e.g. so the muscles still attach well and are useful). It is consistent with an awesome Designer who created his creatures to reproduce and fill the earth (Genesis 1:22; 8:15–17; Isaiah 45:18), adapting to various environments as they did so.

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