

**Giraffe Evolution:  
The Rise and Fall of *Samotherium major* as an  
Intermediate-Necked “Real Missing Link”**

**ABSTRACT**

This article examines the role of *Samotherium major* within a presumed evolution of the Giraffidae and challenges the widespread assumption that it represents a ‘perfectly intermediate’ link between the okapi (*Okapia johnstoni*) and the giraffe (*Giraffa camelopardalis*). While numerous studies and popular-science accounts present *Samotherium* as a ‘truly intermediate’ link, the article demonstrates that this interpretation is only possible if crucial morphological differences and mathematical considerations are disregarded.

An analysis of neck lengths shows that the neck of *Samotherium*, measuring approximately 97.5 cm, is only slightly longer than that of the okapi (approx. 83 cm) but significantly shorter than the neck of modern giraffes (typically 200 – 215 cm, with maxima exceeding 250 cm). A genuinely intermediate value, however, would mathematically have to fall between 141 and 167 cm.

Using the mean value formula  $l_I = \frac{l_O + l_G}{2}$ , the ‘perfectly intermediate’ value can be determined not only between the okapi and the giraffe but, of course, also between any two species. For example, if one inserts 83 cm as the okapi’s neck length ( $l_O$ ) and 215 cm as the giraffe’s neck length ( $l_G$ ), the resulting ‘truly intermediate’ value ( $l_I$ ) is  $\frac{83\text{cm} + 215\text{cm}}{2} = \frac{298\text{cm}}{2} = 149\text{cm}$ .

Furthermore, anatomical investigations indicate several unique features that *Samotherium* shares with neither the okapi nor the giraffe. These concern, above all, the structure of certain cervical vertebrae, cranial elements, and limb bones. This, in turn, means that *Samotherium* is not regarded phylogenetically as a link between the okapi and the giraffe.

The article therefore concludes that *Samotherium* cannot represent a transitional form — let alone a ‘truly intermediate’ link — but rather constitutes an independent, mosaic-like taxon. Consequently, the question of how the giraffe’s extremely long neck originated remains entirely unresolved within an evolutionary framework.

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## INTRODUCTION

### Some notes on the background on which this article has been written:

“This taxon’s proposed position is a key region in the evolutionary tree of giraffids,  
as **it represents a transitional stage of neck elongation.**”

“Both quantitatively and qualitatively, we find the *S. major* neck to **be truly intermediate** between the okapi and the giraffe.”

**Melinda Danowitz, Rebecca Domalski and Nikos Solounias<sup>2</sup>**

“7-Million-Year-Old Fossils Show How the Giraffe Got Its Long Neck.”

“The researchers are calling the remains of this ancient beast true “transitional” fossils, **not only closing an evolutionary gap in the rise of Earth’s tallest animals, but also providing concrete evidence of how one creature evolved into another.**

We actually have an animal whose neck is intermediate [in length] — **it’s a real missing link.**” said Nikos Solounias...”

**Laura Geggel in *Life Science*<sup>3</sup>**

“The front half of the neck vertebrae became elongated in *Samotherium* and *Palaeotragus*,  
**generating forms intermediate between today’s Giraffa and their foreshortened predecessors.**

Then, within the last **two million** years or so, the lineage leading up to the modern Giraffa elongated the back half of their neck vertebrae, giving them even more reach and making them literally at the top of their class.”

**Riley Black in *National Geographic*<sup>4</sup>**

*At How do we know that evolution is real:*

“The fossil record of giraffes is one of the most documented amongst mammals.

Thanks to that, **we know today for sure that giraffes evolved gradually,**  
as one would expect, from a short-necked ancestor.”

**“Wallace” (622,478 views/1.134 comments in 1 year)<sup>5</sup>**

“How the Giraffe Got Its Long Neck: It Happened in Spurts”

“...**the giraffe’s necks didn’t elongate smoothly, but in fits and spurts over millions of years.**”

**Danny Lewis in *Smithonian Magazine*<sup>6</sup>**

“All modern-day giraffes ... descended from a lineage of animals **that somewhat resemble a modern okapi.** ...

Over time, the okapi ancestors shortened their necks ... again, while only the true giraffe ancestors developed spectacularly long necks.

A crucial factor in this **was a second elongation spurt** that began **around a million years ago,**  
during which the lower half of the cervical vertebrae became significantly longer.

Today, the C3 vertebra in the animals’ necks is nine times longer than it is wide,  
reaching dimensions similar to a typical human humerus.”

**Jan Oostercamp in *Spektrum der Wissenschaft*<sup>7</sup>**

They [the authors] found the cranial end of the **vertebra stretched initially around 7 million years ago in an extinct relative of giraffe known as *Samotherium*.** That was **followed by a second stage of elongation on the back or caudal portion around one million years ago.**

**News Staff of *Science News*<sup>8</sup>**

On *Samotherium major*: “Its neck is a **“perfect intermediate”** between the short-neck ancestors and their long-neck descendants.”

“...**a classic transitional form** (f. 14.15): a giraffe fossil with an **intermediate-length neck,** longer than that of the okapi **and the other extinct forms** but shorter than that of the living giraffes”. / “...**a true “missing link”**” (2017)

**Prof. Donald R. Prothero** (Paleontology) (Books 2007 and 2017, paper 2008: See references in the Notes below)

When I (W.-E.L.) recently asked a giraffe expert how long the okapi’s neck is, he replied: “About one meter”<sup>9</sup>. I answered: If the length of *Okapia*’s neck is about 1 meter and the neck of *Samotherium major* is also about 1 meter – how is the length of

<sup>2</sup> <https://royalsocietypublishing.org/doi/10.1098/rsos.150521>: M. Danowitz, R. Domalski and N. Solounias (2015): *The cervical anatomy of Samotherium, an intermediate-necked giraffid.* – W.-E. L and K.F.M.: Let us emphasize that we have nothing personally against the authors – on the contrary: we appreciate their empirical research. However, for us *Science* is the search for truth and as far as we can understand it *Samotherium* as a special proof of Neo-Darwinian evolution is contradicted by the facts presented here. Factual counterarguments are welcome.

<sup>3</sup> <https://www.livescience.com/52903-transitional-giraffe-fossils.html> <https://www.livescience.com/author/laura-geggel>

Also: “For years, there has been scant fossil evidence showing how the giraffe evolved to have such an admirably long neck. But now, the remains of a 7-million-year-old creature with a shorter neck provides proof that the giraffe’s iconic feature evolved in stages, lengthening over time, a new study finds.”

<sup>4</sup> <https://www.nationalgeographic.com/science/article/how-giraffes-became-winners-by-a-neck>

<sup>5</sup> <https://wallaceevolution.tumblr.com/post/63444401777754113/how-did-giraffes-get-their-long-neck-although>

The anonymous blogger “Wallace”- possibly for either Prosanta Chakrabarty (evolutionary biologist at Louisiana State University. Book: Explaining Life through Evolution. MIT Press) or Pratik Chakrabarti (historian of science)?

<sup>6</sup> <https://www.smithsonianmag.com/smart-news-giraffes-evolved-long-necks-spurts-180956886/#>

<sup>7</sup> <https://www.spektrum.de/news/warum-die-giraffe-einen-langen-hals-hat/1378854> “Schon die Urahnen der Giraffe hatten einen wenig längeren Hals – aber nur der der Giraffe wuchs dann anschließend weiter in die Länge.“

<sup>8</sup> <https://www.sci.news/paleontology/science-giraffe-neck-evolution-03321.html>

<sup>9</sup> Mail 8 October 2025.

*Samotherium*'s neck intermediate between the neck of *Okapia* and *Giraffa*?<sup>10</sup> He replied: “I said about – Next time I am at the museum I will measure it exactly<sup>11</sup>. But note some people are taller and some are shorter. We only have one neck<sup>12</sup> of *Samotherium*. The cervical vertebrae are longer in *Samotherium* than in the okapi. So, this observation is more important than the actual neck length.”<sup>13</sup>

Well, if “The cervical vertebrae are longer in *Samotherium* than in the okapi” then how is it possible that the necks of both are of about the same length?

## MAIN PART

### Comparing the neck lengths of *Okapia*, *Samotherium*, and *Giraffa*

The reader is invited to critically check all the numbers in the ensuing calculations

Although there appears to be also some variation in the body length of the okapi, the zoologists J. P. Meireles and S. Hofman state in their monograph on the Okapi (2024, p. 16)<sup>14</sup>: “**Body length is 2.5 m on average for both males and females** (Bodmer and Rabb, 1992).”

Carefully comparing dozens of scientific figures (arduous work) on live okapis and okapi skeletons, a 2.5 m long okapi appears to display a neck length of ca. **83 cm**<sup>15</sup> (neck ratio to the ensuing part of the body about 1 : 2 (83 + 2 x 83 = 249)).

For the neck of *Samotherium major* a length of 3.2 feet (= **97.5 cm**) has been measured. Hence, it is ca. 14.5 cm longer than that of *Okapia* (on average 2 cm per vertebrate – some vertebrae are shorter, especially the atlas, some are longer).

However, to be ‘truly intermediate’ in length between the okapi’s neck and the longest necks of our present giraffes – up to **250 cm** – *Samotherium* would have to display a neck length of **ca. 166.5 (or about 167) cm** and **not only of 97.5 cm**.

Now, taking the usually considered average of the giraffe’s neck length of **200 cm** we still come to ca. **141,5 cm** for a ‘truly intermediate’ link, so approximately **43,5 cm longer** than the neck of *S. major* for such a truly intermediate form (for males: average neck length 215 cm, hence **true intermediate: ~149 cm**). Only if you compare *Samotherium* with some decidedly much smaller female giraffes and disregard all the rest, a truly intermediate length is achieved comparing *Samotherium* with *Giraffa* and *Okapia*.

**By the way, if we ever detected an okapi’s neck of 103 cm or 113 cm length, that *Okapia* would be “the real missing link” between *Samotherium* and *Giraffa*.**

Moreover, for the argument’s sake, let’s take some okapis showing only a neck length of 73 cm and also of 63 cm (for the latter I’m not so sure how a mature okapi would reach plant material on the ground without some effort).

**Giraffe’s neck up to 250 cm:** In case of **73 cm** long necks **in *Okapia***: ‘intermediate links’ of **161,5 cm** would be necessary and for **63 cm** **156.5 cm**.

<sup>10</sup> Mail 9 October 2025.

<sup>11</sup> I had asked: “I have a little question: How long exactly is the neck of the Okapi?”

<sup>12</sup> However, there are also several additional individual cervical vertebrae that have been detected: <https://pmc.ncbi.nlm.nih.gov/articles/PMC4680625/> (Several of C2, C3, C5, C6)

<sup>13</sup> Mail of 10 October 2025

<sup>14</sup> [https://strapi.eaza.net/uploads/2024\\_EAZA\\_Okapi\\_Best\\_Practice\\_Guidelines\\_APPROVED\\_c901c668ed.pdf](https://strapi.eaza.net/uploads/2024_EAZA_Okapi_Best_Practice_Guidelines_APPROVED_c901c668ed.pdf)

<sup>15</sup> A giraffe expert answered my question on the neck length of the okapi recently in a mail as “about 1 m” –relativized it however shortly afterwards but without giving a further answer to it so far.

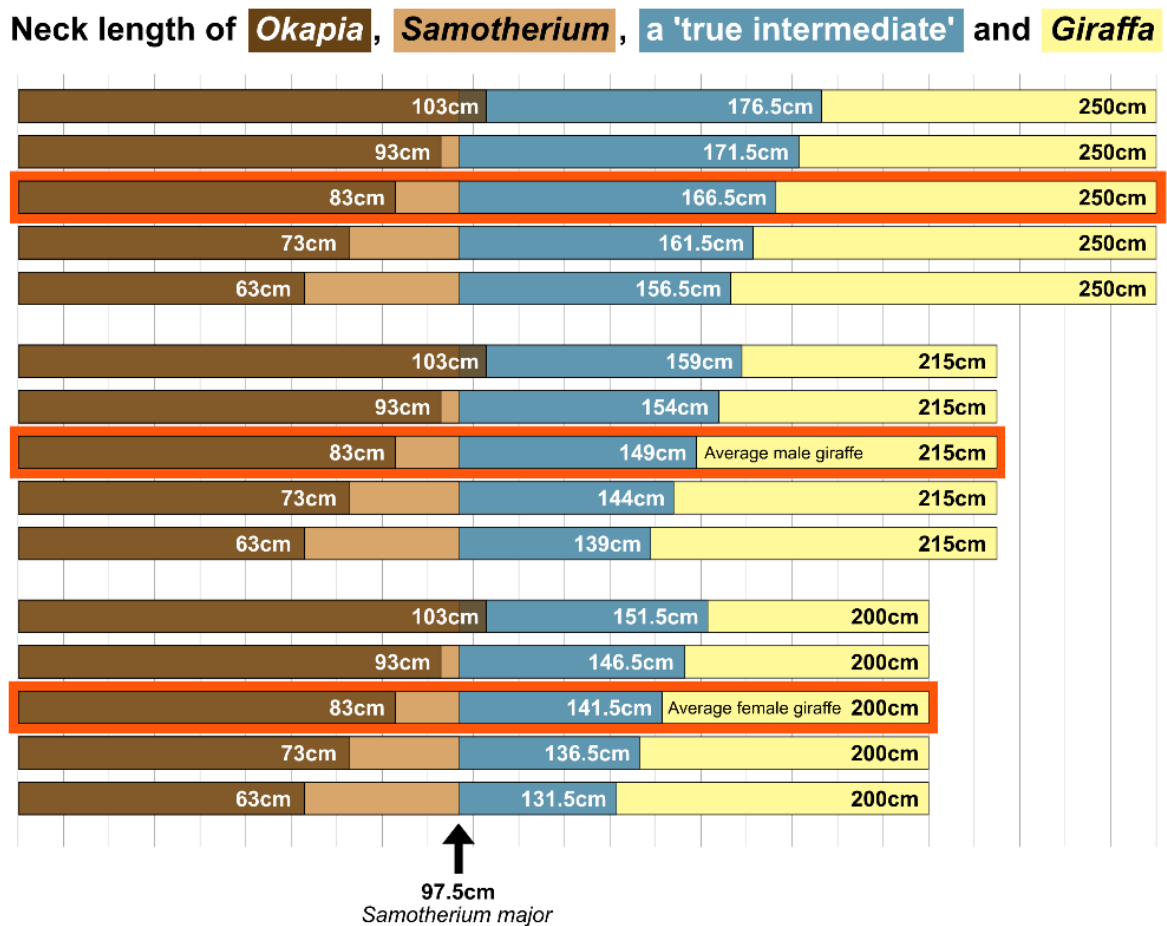
**Giraffe's neck 200 cm:** In case of **73 cm** long necks in *Okapia*: 'intermediate links' of **136.5 cm** and for improbable **63 cm** in *Okapia*: 'intermediate links' of **131.5 cm** would be necessary.

Compare please these results with the neck length of just **97.5 cm** of *Samotherium major*.

Since our giraffe expert is entirely right that variation has to be considered for the comparisons of *Okapia*, *Samotherium* and *Giraffa*, from the very beginning we have first chosen the occasionally cited 250 cm (and sometimes more<sup>16</sup>) for the longest necks of *Giraffa* and then the regularly – in fact the almost always – mentioned length of 200 cm<sup>17</sup> for the length of the giraffe's neck:

**“At maturity, neck length in males and females is ~215 cm and ~200 cm on average, respectively...” – lifelong giraffe researcher Graham Mitchell (2021).**

So, this is the optimal and *scientifically* necessary **basis for any comparisons** of candidates like *Samotherium* for intermediate-necked “Real Missing Links” between *Okapia* and *Giraffa*. The following bar chart will also illustrate these calculations<sup>18</sup>:



<sup>16</sup> For example, zoologist Samuel Richardson: <https://www.youtube.com/watch?v=cT-O0pDcunQ> In the accompanying figure only 2 m are shown, but in the podcast he notes "...the neck of the giraffe despite sometimes being over 2.5 m long..." The Zoology Podcast <https://www.youtube.com/@thezoologypodcast8041>

Another author: "...a neck that can be over 2.5 m long": <https://www.rhulani.com/about/news/rhulani-minute-safari-the-hump-of-the-giraffes-neck>

Height entire animal: "The tallest recorded male was 5.88 m (19.3 ft) and the tallest recorded female was 5.17 m (17.0 ft) tall.[34][31]." <https://wildworldzz.weebly.com/biggest-animals>

<sup>17</sup> <https://academic.oup.com/book/41222/chapter-abstract/350701484?redirectedFrom=fulltext&login=false> "There are few creatures more beautiful, aloof, and fascinating than giraffes. They seem to have reached that rare combination of contentment and serenity that we all strive for." The giraffe is "one of the most strikingly beautiful animals in the creation" Richard Lydekker (1901) cited by G. Mitchell 2021.

The text so far was written (including a preliminary figure) up to 15 October 2025. Also, all the links above were retrieved up to 15 October 2025.

<sup>18</sup> See please, the calculation example at the end of the article. The light brown parts of the bars for *Samotherium* show the differences/distances between the neck lengths of the okapi and the neck length of *Samotherium*.

## Contrasting *Okapia* and *Samotherium* with *Giraffa*



Photographs first row above: **Left:** Male *Okapia* Zoo Cologne Photo: W.-E.L. 16 February 2019. **Middle:** Male *Okapia* Photo: Daniel Jolivet Le parc zoologique de Beauval. Wikipedia: [https://commons.wikimedia.org/wiki/File:Saint-Aignan\\_\(Loir-et-Cher\)\\_Okapi.jpg](https://commons.wikimedia.org/wiki/File:Saint-Aignan_(Loir-et-Cher)_Okapi.jpg) (Retrieved 13 October 2025). **Right:** Female *Okapia* Photo Rau654 <https://de.m.wikipedia.org/wiki/Datei:Okapi2.jpg> (Retrieved 13 October 2025). **Middle Row:** Reconstructions of *Samotherium boissieri* by © Prehistoric Fauna (in wood and steppe) [https://uchytel.com/Samotherium\\_S\\_boissieri](https://uchytel.com/Samotherium_S_boissieri) is thought to be the nearest relative of *S. major*: Bohlin 1926 described it as *S. boissieri* var. *major*. In 1954 Senyürek raised it to the species level: *S. major*. So far, I could not find a more realistic reconstruction for *S. major* (most others are simply false: exaggerated neck length of *S. major*). At present there are also speculations on 'monstrous' body sizes of *S. major*: Even if it were true (1250 kg to 1360 kg instead of ca. 400 kg), **that would not change 97.5 cm found for its neck** (see details above). Result would be: An animal with a very large body and a relatively short neck. **Below:** Giraffe photos by W.-E. L. Left at Zoo Duisburg (photo 12 February 2019). Right at Zoo Cologne (photo 31 May 2021)

***Samotherium* is larger than *Okapia* and its neck is correspondingly longer - probably just a matter of correlation**

The Following is a repeat of <https://www.weloennig.de/GIRAFFAx.pdf> (Now slightly expanded)

## **Some comments on the paper of Danowitz et al<sup>19</sup>: “The cervical anatomy of Samotherium, an intermediate-necked giraffid”**

1. *Samotherium major* is **not an intermediate-necked** giraffid – its entire neck is only slightly longer (ca. 14 cm) than that of the okapi. To be truly intermediate it would have to be almost half a meter longer (see details above and mathematical formula below).
2. As the authors<sup>20</sup> themselves clearly state, *Samotherium major* is **not an ancestor of the giraffe** or the okapi.<sup>21</sup> And I would like to add that **neither are there true/real/valid series of transitional links<sup>22</sup>** of any of the evolutionarily imagined lines of descent, the postulated phylogenetic lineages, assumed to be leading to the long-necked giraffe or okapi (or any other member of the giraffidae) – as the authors also concede<sup>23</sup>.
3. However, the authors repeatedly and emphatically state that “...we find the *S. major* neck to be **truly intermediate** between the okapi and the giraffe” – and they use the term “intermediate” for their findings and descriptions almost mantra-like **28 times<sup>24</sup>** in their paper – including **4 times** as “**truly intermediate**”. Could the fact that *Samotherium major* **was definitely not an ancestor of the short-necked or long-necked giraffe** perhaps be lost by some readers by so many suggestive repetitions?<sup>25</sup>
4. Nevertheless, on p. 16 the authors point out that “*Samotherium major* exhibits **several unique morphologic features that are absent in** the *G. camelopardalis* and *O. johnstoni* cervical vertebrae” – and they continue:

“In *S. major*, the cranial-most aspect of **the spinous process of C2 is positioned caudally to the dens**, whereas in *G. camelopardalis* and *O. johnstoni* it reaches the level of the dens. This increases the space between the atlas and axis, and would allow for increased dorsally directed motion of the atlas and the head. *Samotherium major* also has **an atypical skull feature**, where **the occipital bone protrudes caudal to the skull** (figure 8). We believe these two features are interrelated. Moreover, the dorsal lamina of *S. major* cervicals has a **fossa**, lateral to the spinous process. Ridges formed from the attachment of the multifidus muscle create this concavity. While *S. major* shares many features with the two extant giraffids, **this extinct taxon also demonstrates characteristics atypical of giraffids, and ruminants in general.**”

Before that they mention about *Samotherium*:

“*Samotherium major* **exhibits cervical vertebral features that are uncharacteristic of ruminants**. The *S. major* cervicals, in lateral view, have a ‘wedged’ morphology, where the caudal end of the vertebra has more depth, and the cranial end is smaller. This is **atypical of ruminants**; normally, the vertebral body and pedicles are of relatively equal size throughout the length. Several muscles that originate in the thorax insert on the caudal aspect of the cervical vertebrae...”<sup>26</sup> (Further details in Solounias 2025, p. 53.<sup>27</sup>)

<sup>19</sup> <https://royalsocietypublishing.org/doi/10.1098/rsos.150521>: M. Danowitz, R. Domalski and N. Solounias (2015): The cervical anatomy of *Samotherium*, an intermediate-necked giraffid.

<sup>20</sup> See again <https://royalsocietypublishing.org/doi/10.1098/rsos.150521>, cf. moreover <https://www.cambridgescholars.com/resources/pdfs/978-1-5275-8686-4-sample.pdf> p. 12.

<sup>21</sup> The authors state on p. 2 of the first contribution mentioned in the links above that “*Samotherium major* is **not a direct ancestor** of the giraffe or the okapi...” Well, it is neither a “direct” nor “indirect” ancestor – if such an ancestor ever existed in the latter sense; **this species is not an ancestor of the giraffe or okapi at all.**

<sup>22</sup> For the categorical difference between the adjectives “transitional” and “intermediate” see <https://www.weloennig.de/ElephantEvolution.pdf> p. 51.

<sup>23</sup> And before that quote, also on p. 2, they (M.D. and N.S. who wrote the manuscript) say: “While they [the “intermediate-necked giraffids”] are closely related, these species are **not direct ancestors** to the long-necked giraffe.” **Incidentally**, I have nothing against the authors; rather, I appreciate their empirical work. However, we disagree on the topic of that “truly intermediate.”

<sup>24</sup> Plus in the title **29 times**.<sup>27</sup> (Retrieved 18 March 2025)

<sup>25</sup> This is, of course, what most people of the evolutionary audience fervently like to hear. However, “vox Populi” is not necessarily “vox Dei” as already Darwin mentioned for science: Cf. <https://www.weloennig.de/AuAbl.html>

<sup>26</sup> “...which is more extensive in *S. major*. We believe this matches the verticality osteological features, and that the presumed verticality of this extinct giraffid was strongly reinforced by muscular connections between the thorax and neck.”

<sup>27</sup> For more **non-intermediate** features of *Samotherium* between Okapi and Giraffe, see: <https://palaeo-electronica.org/content/2016/1702-the-metapodials-of-giraffidae>

Nikos Solounias states in his excellently researched book *Putting Samotherium in its Place* (2025, pp. 87/88 – under the subheading *Evolutionary comparisons of Samotherium with the okapi and the giraffe*)<sup>28</sup>:

“The okapi has a large frontal sinus and so does the giraffe. *Samotherium* does not. This feature is suggestive of the two living taxa being closely related. However, there is little more similarity and it is more likely that the frontal sinus is a parallel evolution. The dentition is more brachyodont and plesiomorphic in the okapi and the giraffe. In *Samotherium* there is a slight hypsodonty and some reduction on the premolars making this taxon unique. **The ossicones are different in all three species** and this does not give a signal<sup>29</sup>. The cervical vertebrae are elongated in *Samotherium* which brings it closer to the giraffe. The metapodials are stout in *Samotherium*. **Thus, they differ from both the okapi and the giraffe.** In conclusion, **only the neck elongation brings *Samotherium* closer to the giraffe.** Similarly, the frontal sinuses bring the okapi closer to the giraffe. It seems that these three species cannot be brought closer in terms of evolution. Thus, **they are in three isolated silos of the Giraffidae.**”

Later the author specifies that “The Giraffidae form a number of subfamilies which are not directly connected” (still p. 88). [*Samotherium* belongs to a different subfamily than *Giraffa*.]

In his equally well researched book *Anatomy and Evolution of the Giraffe – Parts Unknown* (2024, p. 117)<sup>30</sup> Solounias mentions that:

“There are some cladograms of the giraffids (Hamilton 1978; Geraads, 1986; Janis and Scott 1987; Solounias 2007; Rios et al. 2017). **The outcomes of these are different.**”<sup>31</sup>

And he explains in the next paragraph (same page):

“What I observe with the classifications of the Giraffidae, is that **one cannot make an evolutionary sequence across taxa. One cannot make a sequence however general.** That is, not real steps but a simulation of the unknowable real steps well enough to develop an understanding<sup>32</sup>. The meaning of this heterogeneity of the genera is most likely due to them truly **evolving independently within each subfamily.** What I suggest is that in Giraffidae there was an early large adaptive radiation and subsequently species evolved in silos of their respective subfamily. Uniting the subfamilies is very difficult because of these early adaptive radiations.”

Similarly on p.118 he proposes “that most of these are distinct subfamilies that go back in time to the very beginning of Giraffidae.”

Now, returning to our initial question: Is the *S. major* neck “**truly intermediate** between the okapi and the giraffe”? Or, to take the summarizing closing sentence of Danowitz et al. (p. 17): “**Both quantitatively and qualitatively,** we find the *S. major* neck to be **truly intermediate** between the okapi and the giraffe” – Is this scientifically correct?

You, the reader, are invited to check the facts and decide.

5. Well, as far as I can understand it: Fact is that ***we have not discovered a single transitional form, i.e. not detected even one truly transitional link (or an intermediate mosaic form) of the evolutionarily imagined lines of descent*** (the postulated phylogenetic lineages) assumed to be leading **directly/straightforwardly** to the long-necked giraffe or okapi or any of the other subfamilies.
6. **“A true evolutionary story is not available” (Solounias 2022 and 2024, p.12).**<sup>33</sup>  
For all the additional anatomical and further details, I recommend the analytical study of the papers and books cited.

<sup>28</sup> In: Solounias, N. (2025): *Putting Samotherium in its Place: The Morphology of Giraffids and the Geology of Samos*. Cambridge Scholars Publishing, Newcastle upon Tyne, England. (269 pp.)

<sup>29</sup> W.-E.L.: Perhaps independently designed concerning this feature?

<sup>30</sup> Solounias, N. (2024): *Anatomy and Evolution of the Giraffe – Parts Unknown*. Cambridge Scholars Publishing, Newcastle upon Tyne, England. (194 pp.)

<sup>31</sup> See also the contradictory evolutionary trees in Lönnig (2011, pp. 78 – 80): [https://ad-multimedia.de/evo/long-necked-giraffe\\_mU.pdf](https://ad-multimedia.de/evo/long-necked-giraffe_mU.pdf)

<sup>32</sup> Presupposes his evolutionary worldview, suggesting the hypothesis that follows (as quoted above).

<sup>33</sup> Solounias 2022, p. 12 in: <https://www.cambridgescholars.com/resources/pdfs/978-1-5275-8686-4-sample.pdf> as well as (2024) in his book *Anatomy and Evolution of the Giraffe – Parts Unknown*. Cambridge Scholars Publishing, Newcastle upon Tyne, England.

7. In principle, the present example (including the mathematical formula – see below) can also be applied on further instances of giraffid genera with slightly elongated necks as compared to *Okapia* (W.E.L.: *The Giraffe Fossil Record* – in preparation).

## **History of the investigations and predictions on intermediate giraffids by W.-E. L.**

From [https://ad-multimedia.de/evo/long-necked-giraffe\\_mU.pdf](https://ad-multimedia.de/evo/long-necked-giraffe_mU.pdf)

(2011, pp. 22 to 27 and 128 to 130)

Perhaps especially interesting for historians of biology

### **Pp. 22 to 27 (page numbers within the following text refer to the pages of the book):**

(1d) Supplement from **23 April 2006 and 1 May 2006**: Since I want to keep my readers as correct and up-to-date as possible, I feel obliged to add the following points to the discussion on the origin of the long-necked giraffes: On 21 April 2006, Dr. X partially retracted his statement. However, the facts – if there are any – on which this retraction was based, and which would support a view partially in opposition to his clear and unequivocal previous statements as well as those of the other giraffe specialists quoted above, are not known to me. (Such fully new facts must therefore have been discovered in the last couple of weeks, yet I have heard nothing of this. His *hypothesis* is that the neck vertebrae were first lengthened stepwise, and then a quantum mutation produced the duplication of a cervical vertebra.) Therefore, I sent him the following questions (22 April 2006) concerning his statement "I have intermediates with partially elongated necks but they are unpublished":

“If you really have intermediates (How many? Really a continuous series leading to the long-necked giraffes? What does "partially elongated" exactly mean? Are the intermediates really "intermediate" in the strict sense of the term?), which are relevant for the origin of the long-necked giraffes and which are occurring in the expected, i.e. "correct" geological formations (taking also into account the sexual dimorphism of the species and excluding juvenile stages and the later pygmy giraffes etc.), bridging in a gradual/continuous fashion of small steps in Darwin's sense the enormous gap between the short-necked and long-necked giraffes, I can only advise you to publish these results as a *Nature* or *Science* paper as soon as possible. And if you have, in fact, unequivocal proofs, I can only add that I, for my part, will follow the evidence wherever it leads. So, drop all secondary things and publish it as rapidly as you can.”

He replied, but did not answer these questions, neither does he intend to publish his findings this year. So, at present I have no reasons to doubt that his original clear statements as quoted in the main text of the article were essentially correct and that Gould's verdict quoted on page 1 of the present article in accord with the answers of the other giraffe specialists, is still up-to-date.

But let's assume for a moment that there once existed say **2 or 3 further mosaic forms with some intermediary features**: Would that prove the synthetic theory to be the correct answer to the question of the origin of the long-necked giraffes? As the quotation of Kuhn shows (see p. 20 above) that would be circular reasoning as long as the problem of the causes of such similarities and differences have not been scientifically clarified (just *assuming* mutations and selection is not enough). In 1990 and 1991, I wrote:

Since roughly half of the extant genera of mammals have also been detected as fossils (details see <http://www.weloennig.de/NeoB.Ana4.html>), one might – as a realistic starting point to solve the question of how many genera have existed at all – double the number of the fossil forms found. Thus, there does not seem to exist a larger arithmetical problem to come to the conclusion that by also **doubling the intermediate fossil genera so far found (which represent in reality most often mosaics) one cannot bridge the huge gaps between the extant and fossil plant and animal taxa.**

However, from this calculation it seems also clear that **in many plant and animal groups further mosaic forms (but not genuine intermediates) will most probably be found, which**

**will nevertheless – on evolutionary presuppositions – be interpreted as connecting links.** Since the quality of the fossil record is often different for different groups (practically perfect concerning the genera in many of the cases mentioned by Kuhn above, but in other groups imperfect), it is not easy to make definite extrapolations for the giraffes. My impression is, however, that **with about 30 fossil genera** already found (only *Giraffa* and *Okapia* still extant), the number still to be discovered might be rather low (generously calculated **perhaps a dozen further genera may be detected by future research**). As to the origin of the long-necked giraffes one may dare to make the following predictions on the basis that at least about half of the giraffe genera have been detected so far:

(a) **A gradual series of intermediates** in Darwin's sense (as quoted above on page 3) **has never existed and hence will never be found.**

(b) Considering *Samotherium* and *Palaeotragus*, which belong to those genera which appear to display (to use the words of Dr. X) "some differences in the short vertebrae", **a few further such mosaics might be discovered.** As mosaics they will **not** unequivocally be "connecting any of the fossil taxa [so far known] to *Giraffa*". Nevertheless, **gradualists would as triumphantly as ever proclaim them to be new proofs of their assumptions** (thus indicating that hardly any had been detected before).

c) The duplication of a cervical vertebra excludes by definition a gradual evolution of this step – by whatever method the giraffes were created.

**Note of 9 October 2008 (last modified 16 November 2008):** Ever since the present article appeared online, some evolutionists seem to have been eagerly looking for "missing links" or transitional forms and recently they claimed to have found one (see, for example, <http://www.conservapedia.com/Giraffe> and Note below\*). **If true, it would show how extraordinarily fruitful the present article has been for scientific research.** However, there is strong reason to doubt that the neck of this so far **un**published fossil specimen "is a perfect intermediate between the short-neck ancestors and their long-neck descendants". For the time being, the main reason is that some of long-necked forms are most probably **older** than this fossil "link" (a candidate fossil link should come at least from the **Middle Miocene**, and not be described "from the late Miocene and early Pliocene"). Remember, please, that – as stated on page 13 – according to Carroll (1988/1993, p. 629) **the first fossil evidence for the genus *Giraffa* is from the Middle Miocene.** And this is corroborated by fossils of ***Giraffa priscilla* from the Middle Miocene of Ramnagar**, India (Basu 2004, see Note <sup>(2a1)</sup> in the second part of the paper). Thus, the fossil with its 'perfectly intermediate neck' cannot be in the assumed phylogenetic lineage leading to the long-necked giraffes.

Also, both long-necked giraffes and the species with its 'perfectly intermediate neck' lived contemporaneously for millions of years like many other presumed ancestors of the giraffe with some intermediary features (see the figure on page 10 in Part 2).

Another question could be: Does the fossil whose neck is thought to be a "perfect intermediate..." (see above) have 7 or 8 cervical vertebrae?\*

Moreover, except for the assertion concerning the neck just quoted, a description of the other parts of the unpublished fossil animal is not known to me; yet a mosaic-like combination of the neck with uniquely derived (autapomorphic, 'new-featured') characters not fitting into the presumed giraffe line **may exclude it from the long-necked giraffe's ancestry per se** (as is usually the case with "missing links" or "transitional forms"). Hence, this question has to be carefully investigated too.

As for possibilities and predictions of 2006 concerning intermediate forms mentioned in the present paper (“**2 or 3 further mosaic forms with some intermediary features**” in the ‘right’ geological strata, but **no continuous series in Darwin’s sense** and “as mosaics they will **not** unequivocally be “connecting any of the fossil taxa to *Giraffa*””), see here pp. 22 and 23, and Part 2 (2007), pp. 6-11, 24-25, 28, 33-48. Considering the facts and arguments presented on these pages, there is, in principle, **nothing new** with another relatively small adult giraffe-like animal, which is, geologically speaking, **younger** than the long-necked giraffes (see, for instance, the pygmy-giraffes mentioned above and in Part 2 of the paper, pp. 7, 24, 34, 54 and, perhaps in part, also the zoo giraffes referred to in Part 2 as well (p. 84), not to speak of the females and young ones). However, if the fossil find with the intermediate neck **were older** than the long-necked giraffes, than it could be a good candidate for my prediction of “2 or 3 further mosaic forms with some intermediary features” – here especially the (7 or 8) shorter neck vertebrae – in the ‘right’ geological strata, granted that it would be an adult male animal, or at least the sexual dimorphism could be taken into account, and that the factor ‘modification’ could be neglected.

And, of course, **an absolutely ingenious and prolific mind** having generated and sustaining the laws of physics (as, for example, also many Nobel laureates of science have inferred for the origin of the universe: <http://www.weloennig.de/Nobelpreistraeger.pdf>), **has the potential to create as many mosaic forms with some intermediary characters as are imaginable within functional limits**, front-loaded or otherwise, but hardly so by "infinitesimally small inherited variations", "steps not greater than those separating fine varieties" and "insensibly fine steps", "for natural selection can act only by taking advantage of slight successive variations; she can never take a leap, but must advance by the shortest and slowest steps" – see Darwin as quoted on p. 3 above in agreement with the basic assumptions of modern neo-Darwinism (“Macroevolution ... is composed of numerous small microevolutionary steps (additive typogenesis)” or of “uncountable successive small microevolutionary steps....” – see the details above).

So, this is **what the synthetic theory really needs to prove its case for the giraffidae**: many **continuous series in Darwin’s sense, not isolated genera with some intermediary features** appearing as late as or later than the long-necked giraffes and living contemporaneously with them for millions of years.

The reason or basis for the absence of such continuous series may consist in the functional limits due to the law of correlation (Cuvier) on almost all biological levels, and to the related law of recurrent variation concerning mutagenesis (<http://www.weloennig.de/Loennig-Long-Version-of-Law-of-Recurrent-Variation.pdf>) corroborating Cuvier’s insights. He defined the law of correlation as follows:

**“Every organized being constitutes a whole, a single and complete system, whose parts mutually correspond and concur by their reciprocal reaction to the same definitive end. None of these parts can be changed without affecting the others; and consequently, each taken separately indicates and gives all the rest.”**

<http://aleph0.clarku.edu/huxley/comm/ScPr/Falc.html> (See the French original text below.\*\*\*)

Living beings are, in fact, highly integrated, functional systems (all parts being correlated with limited space or tolerance concerning functional variation), which permits microevolution generating intermediate forms to a certain extent, but precludes infinite transformations. The law of correlation can be illustrated by Pierre Paul Grassé’s remark on the eye as follows:

“In 1860 Darwin considered only the eye, but today he would have to take into consideration all the cerebral connections of the organ. The retina is indirectly connected to the striated zone of the occipital lobe of the cerebral hemispheres: Specialized neurons correspond to each one of its parts – perhaps even to each one of its photoreceptor cells. The connection between the fibers of the optic nerve and the neurons of the occipital lobe in the geniculite body is absolutely perfect.”

As to the eye, see please <http://www.weloennig.de/AuIn.html>. We have seen on pp. 9 and 10 above, how the law of correlation is also relevant for the long-necked giraffes as coadaptation/synorganization.

Every **intermediate macroevolutionary step** would thus necessitate the **coordinated change of many genes and physiological and anatomical functions**. How much faith is required to believe that random ('micro'-) mutations could really afford this task? What about intelligent design to implement such or similar steps?

Another point: Prof. W. R. Thompson made the following instructive comment on intermediates in his introduction to Darwin's *Origin of Species* on the geographic level, properly applying this insight also to paleontology (1967, p. xix):

“As the range of our collections extends, so we invariably enrich our representation of various groups, and this **necessarily and inevitably entails the appearance of intermediates between the forms in the collection** from the restricted area in which we started. The recognition of this fact, with respect to the collections of organisms existing here and now, **does not necessarily commit us to any particular view of the origin of species**; and the same thing is true of the collection of fossil material.”

Morphologic space within families like the giraffidae is not infinite and thus **unavoidably entails the existence of at least some ‘intermediates’ (more exactly, ‘mosaic forms’)** in any family with a plethora of genera and species, whatever their cause of origin. To a certain extent this appears to be true also for some higher taxonomic entities. Yet, as Thompson aptly stated on p. xvi of his introduction:

“On the Darwinian theory, evolution is essentially undirected, being the result of natural selection, acting on small fortuitous variations. The argument specifically implies *that nothing is exempt from this evolutionary process*. Therefore, *the last thing we would expect on Darwinian principles is the persistence of a few common fundamental structural plans* [the phyla and within them the many equally well defined subordinate groups]. Yet, this is what we find.”<sup>o</sup>

Hence, a general assertion of a “**perfect intermediate**”<sup>v</sup> for the neck of the giraffe to prove Darwin's idea of evolution by “insensibly fine steps” etc. without the indispensable scientific discussion of the details and objections mentioned above, *may be quite useful for propagandistic purposes on the false premise that only a mindless process could be responsible for its origin*<sup>x</sup>, but is **definitely insufficient and unqualified on the scientific level**. Let us hope that an unbiased, profound and critical scientific report on the fossil find will follow soon.

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\*Donald Prothero: *What missing link?* New Scientist, 27 February/1 March 2008, pp. 35-41. On page 35 we read: “Darwin's 1859 prediction that transitional forms would be found was quickly confirmed.” Yet, Prothero qualifies the term “transitional form” as follows: “A transitional form need not to be a perfect halfway house directly linking one group of organisms to another. It merely needs to record aspects of evolutionary change that occurred as one lineage split from another”. [Comment 21 October 2025: This “definition” is so imprecise that almost anything can be proved by it for evolutionary purposes. It naively presupposes the entire Darwinian worldview.]

However, according to the same author, the situation seems to be somewhat different in the case of the giraffe, for he answers the question “**How did the giraffe get its long neck?**” with the ensuing sentences (p. 40): “This question has puzzled biologists as far back as the early 18<sup>th</sup> century naturalist Jean-Baptiste Lamarck, who famously – and wrongly – speculated that the giraffe's ancestors had stretched their necks in search of food and passed this “acquired characteristic” onto their offspring.”

Here Prothero omits to mention that Darwin speculated in a similar way as follows (*Origin of Species*, 1872/1967, pp. 24/25):

“**Changed habits produce an inherited effect** as in the period of the flowering of plants when transported from one climate to another. **With animals the increased use or disuse of parts has had a more marked influence.** The great and inherited development of the udders in cows and goats in countries where they are habitually milked, in comparison with these organs in other countries, is probably another instance of the effect of use. Not one of our domestic animals can be named which has not in some country drooping ears; and the view which has been suggested that **the drooping is due to the disuse of the muscles of the ear**, from animals being seldom alarmed, **seems probable.**”

And concerning the origin of the giraffe, Darwin combined natural selection with “the inherited effects of the increased use of parts” (p. 202):

“...natural selection will preserve and thus separate all the superior individuals, allowing them to intercross, and will destroy all the inferior individuals. By this process long continued, which exactly corresponds with what I have called unconscious selection by man, *combined no doubt in a most important manner with the inherited effects of the increased use of parts*, it seems to me almost certain that an ordinary hoofed quadruped might be **converted into a giraffe.**”

Prothero continues: “The giraffe fossil record is fairly good, with a wide variety of species known from the Miocene. These sported a range of weirdly shaped horns, *but all had short necks rather like that of the only other living species of giraffid, the okapi.* Only in the late Miocene do we see the fossils of long-necked giraffes. Like modern giraffes, they have an extra vertebra in the neck - recruited from the back - and lengthened neck vertebrae.

Until recently, there was **no fossil evidence linking the long-necked giraffes to their short-necked relatives.** But as my book went to press, news emerged that Nikos Solounias of the New York Institute of Technology had described [but not yet published] a fossil giraffe from the late Miocene and early Pliocene. **Its neck is a perfect intermediate between the short-neck ancestors and their long-neck descendants**” (emphasis added).

Thus, Prothero’s message clearly is: Now we have, indeed, fossil evidence (although unpublished so far) **linking** the long-necked giraffes to their short-necked relatives. If the neck were a “perfect intermediate” (“a perfect halfway house”, which may be doubted for the reasons given above) – what about all the other features of the animal? (See the facts and arguments concerning coadaptation/synorganization listed on pp. 4, 9, and 10.)

Also, Prothero’s assertion that “A transitional form ... merely needs to record aspects of evolutionary change that occurred as one lineage split from another” presupposes much of the neo-Darwinian worldview of continuous evolution and is at odds with, for example, T. H. Huxley’s drawing of a hypothetical intermediate link between dinosaurs and birds, displaying an entire range of intermediate characters.

\*\*If, however, V8 (see Part 2, p. 15) displayed further intermediate features, Lankester’s hypothesis that this neck vertebra was only a “cervicalized” thoracic would be reinforced.

\*\*\* **Georges Cuvier (1798)**: “Tout être organisé forme un ensemble, un système unique et clos, dont les parties se correspondent mutuellement, et concourent à la même action définitive par une réaction réciproque. Aucune de ces parties ne peut changer sans que les autres changent aussi; et par conséquent chacune d’elles, prise séparément, indique et donne toutes les autres” (Cuvier 1825): <http://records.viu.ca/~johnstoi/cuvier/cuvier-fl2.htm>.

There are several English translations. This one is also fine:  
 “Every organized being forms a whole, a unique and closed system, in which all the parts correspond mutually, and contribute to the same definitive action by a reciprocal reaction. None of its parts can change without the others changing too; and consequently each of them, taken separately, indicates and gives all the others.”  
[http://www.ansp.org/museum/jefferson/otherPages/cuvier\\_revolutions.php](http://www.ansp.org/museum/jefferson/otherPages/cuvier_revolutions.php)

Similarly the botanist **Antoine-Laurent de Jussieu** stated (1789): “C'est dans cette dépendance mutuelle des fonctions, et ce secours qu'elles se prêtent réciproquement, que sont fondées les lois qui déterminent les rapports de leurs organes, et qui sont d'une nécessité égale à celle des lois métaphysiques ou mathématiques: car il est évident que l'harmonie convenable entre les organes qui agissent les uns sur les autres, est une condition nécessaire de l'existence de l'être auquel ils appartiennent, et que si une de ses fonctions étoit modifiée d'une manière incompatible avec les modifications des autres, cet être ne pourroit pas exister” (quoted according to evolutionist Jean-Pierre Gasca (2006): Cent ans après Marey: Aspects de la morphologie fonctionnelle aujourd'hui, Comptes Rendus Palevol 5, 489-498).

**Any scientist who has ever systematically worked with mutants will immediately be able to give a range of examples corroborating this verdict.**

.....

∇As implied by the text above, this would also be true for a general assertion concerning **several** of such “intermediate” genera. What Darwinism needs to prove its case for the giraffidae and other families are ‘unmistakable species-to-species transitions’ etc. (see above pp. 11, 15/16, 19).

### **Pp. 128 to 130:**

**Prothero, D. R.** (2007): *Evolution: What the Fossils Say and Why It Matters*. Columbia University Press, New York. [Postscript 20 October 2025: **Second edition 2017, p. 340**]

I first saw Prothero's comments on the giraffe from his book on 26 September 2011. Prothero, who – in contrast to Badlangana et al. 2009, p. 739 (“the giraffe has only seven cervical vertebrae”) – fully accepts Solounias’ understanding of the duplication of a neck vertebra (thus 8 neck vertebrae) implying also the loss of a thorax vertebra, **triumphantly points out to “a classic transitional form (f. 14.15): a giraffe fossil with an intermediate-length neck, longer than that of the okapi and the other extinct forms but shorter than that of the living giraffes”** (p. 316).

See, please, my comments on that intermediary form on pp. 24-26. For more or less intermediary cervical vertebrae, Prothero could as well have quoted the long known *Palaeotragus germaini* (although with only a single C6 measurement) and many species of *Samotherium* (see discussion above pp. 76-78, 81, 85, 98/99 and 116/117).

The “new”(?) fossil form seems to be in agreement with **my scientifically based prediction (2006, see p. 24 above) of “2 or 3 further mosaic forms with some intermediary characters” yet to be found** (see also Lönning 2002 <http://www.weloennig.de/NeoB.Ana4.html> as well as 1990/1991 for the predicted duplication to quadruplication of the number of the mammal fossil forms so far discovered including ‘intermediary’ ones) – in the case of the giraffe especially if detected in the “right” geological strata. By the way, Prothero also stated in 2007(!) that “Nikos Solounias is currently publishing a description of that fossil form” – So far (Oct. 2011) this doesn’t seem to have happened, but, of course it may need more time.

Subsequently Prothero continues (still p. 316): **“For so many years people have speculated about how giraffes got their long necks, and now we finally have the fossils to show exactly how it happened.”** Well, from an undescribed fossil except a drawing of its probably intermediary long neck vertebrae – similar to those of *P. germaini* or *Samotherium africanum* or *S. sinense* – **he now knows “exactly how it happened”**? Isn't it surprising that most other evolutionary biologists haven't received that good news yet so long hoped for? *How does this so far undescribed fossil show that the species that once roamed the earth was the result of "an unguided, unplanned process of random variation and natural selection" – according to a definition of evolution endorsed by 38 Nobel Laureates in 2005?*

So, what does this phenotype really tell us about its evolutionary genetics? How did its (unknown) DNA-sequences differing from its assumed but unidentified nearest ancestors and its new genes come about? (For the problems involved in these questions, see Axe 2000, 2004, 2010, Gauger et al. 2010, 2011, even for seemingly closely related enzymes). Above I have

already quoted the evolutionary biologists Badlangana et al. (2009): “The current state of knowledge on both the fossil record and sources of influence on developing embryos does not allow for either a gradualistic (microevolutionary) or punctuated interpretation of the evolution of the elongated giraffe neck to be supported over the other...” (see p. 117 and below p. 131).

Now, let's assume – in spite of all the unanswered questions and contradictions listed on pp. 23-26 – that the fossil form in question would indeed be “**a perfect intermediate**” in all its features (including a neck vertebra “half duplicated” and a thorax vertebra “half deleted” so to speak): Would that help solving the problem discussed by Badlangana et al. just quoted? The authors mention that “in the literature [...] there is a tendency to argue towards the microevolutionary gradualistic occurrence, where slow, progressive elongation of the giraffe neck took place” and they discuss a microevolutionary scenario vs. a punctuated one in relation to the difference only between *Palaeotragus primaevus* and *P. germaini* (on the basis of “a single C6 vertebra”, which is about 10 cm or more shorter than that of the fossil of *G. camelopardalis* referred to) and a gap of about 2 million years between the two species, but definitely not the modern giraffe, wrongly assuming that *P. germaini* would already display neck “elongation of modern giraffe proportions” (see the discussion above pp. 116/117)” as follows (2009, pp. 753/754, bold added):

“If such a microevolutionary scenario holds true, where a series of adaptive morphological changes occurred in response to climatic and vegetative variation during the Miocene, then individual cervical vertebral lengths and entire vertebral column lengths for fossil species in the Palaeotraginae should gradually adopt extant giraffe-like proportions. Over this 2-Myr period, based on a generation time of 5 years between birth and first parturition in extant female giraffes (Dagg & Foster, 1976), and a generation time of less than 3 years in extant okapi (Bodmer & Rabb, 1992), between 400 000 and 666 666 generations of palaeotragines may have occurred. The lengthening of the cervical region between *P. primaevus* and *P. germaini* was in the range of 350–570 mm (... [method of calculation given]), **thus requiring an average increase in CVLs [total cervical vertebrae lengths] of between 0.72 and 1.19  $\mu\text{m}$  per generation to reach extant giraffe proportions in this time period.**”

Not the extant giraffe proportions, but only the difference between *Palaeotragus primaevus* and *P. germaini* (see the details above). **Thus, are there really decisive selective advantages for the survival of giraffe populations of about 1 millionth of 1 meter or 1 thousandth of 1 mm higher in each generation? And that for about 500,000 or so generations each reaching 1 thousandth of 1 mm higher than their ancestors into the canopy of the last leaves during a dearth?** (Not to mention the smaller females, juveniles and Haldane's dilemma.)

And now the punctuated scenario<sup>34</sup> according to Badlangana et al. (2009, p. 754): “With a generation time of 5 years between birth and first parturition among extant female giraffes (Dagg & Foster, 1976), and less than 3 years in extant okapi (Bodmer & Rabb, 1992), between 2000 and 3333 generations could occur in the 10 000 years allowed for in a punctuated event by Eldredge & Gould (1972). A punctuated event occurring over such a brief period of geological time could be essentially invisible in the fossil record. Given that we are most likely to be discussing an increase in total length of the cervical vertebrae of approximately 477 mm between *P. primaevus* and *P. germaini* (calculation presented above), an average increase of 143.1-238.5  $\mu\text{m}$  per generation would be sufficient in the time proposed for a punctuated event to acquire extant giraffe cervical proportions.” Again, definitely not “extant giraffe cervical proportions”. Even their “calculated TVL [total vertebral column length], giraffe regression” of Table 4, p. 740, shows a mean difference between the *G. camelopardalis* and *P. germaini* of 1059.8 mm, for the “calculated TVL ungulate regression” a difference of 1456.8 mm, for the “calculated NVL [calculated normalized vertebral length], giraffe regression” 420.2 mm, and for the “calculated NVL, ungulate regression” 1033.1 mm. All these relations and computations, to emphasize this point again, are based on just a single C6 – and this one is only “probablement” a C6 according to the original account of Arambourg 1959, p. 103, raising some doubts on their calculations in relation to it: for almost all values would have to be changed and the differences to *G. camelopardalis* described above would become greater and probably also more consistent with the rest of the *P. germaini* fossil material if it were a C3, C4 or C5; since so much depends on that unsure C6, I would like to suggest to examine Arambourg's original fossil again. Moreover, it is definitely not correct to take an extant young giraffe, like ZA1253 of their Table 3, p. 739, of about 1-1.5 years old for comparisons with (the fossil) *P. germaini* (p. 749: “...the length of the single C6 of *P. germaini* indicates that it is consistent with the sizes

<sup>34</sup>As noted before: Even though additional research over the past few decades **has confirmed punk eek's general description of the fossil record** (“long periods of stasis followed by rapid changes”), its factorial system, which includes allopatric speciation and species selection as its primary components, has ultimately ended up in “**good, old-fashioned natural selection acting on random mutations and variations – that is, [...] the Neo-Darwinian mechanism acting over long periods of time on large, relatively stable, populations**”. Details in <https://www.weloennig.de/ElephantEvolution.pdf>, p. 5

obtained from young adult extant Giraffa...” – well, is a giraffe of 1 to 1,5 years a ‘young “adult”’? Age of sexual maturity: 6-7 years, apart from the question whether it was a male or female, see the 1 to 1.5 m difference in height above pp. 39, 41, 67), for they also state on that page that “We assumed that all fossil specimens were derived from fully mature adults...” (emphasis added). However, when comparing extant young giraffes (ZA1265 [0.5-1 year] and/or ZA1253) with different adult fossil or contemporary species, one could speak of cervical vertebrae sizes of several further mammals like *Camelus dromedarius*, *Lama glama*, *Tragelaphus strepsiceros* and *Kobus ellipsiprymnus* of their Table 1 to be consistent with “extant giraffe cervical proportions”, especially if one compared a female young adult with them, not to speak of a comparison between the latter and a fully mature adult male of *P. germaini*. So, the differences between males and females of *G. camelopardalis* (see systematic measurements by Harris 1976, p. 287, Table II) and others (possibly by DNA tests for fossils) would also be very important. Additionally, may I also suggest that the authors should perhaps better (or at least also) have compared (the fossil) *P. germaini* with the fossil *Giraffa*, which latter seem to be larger than the extant giraffes, not least as to be deduced from the C7 (compare their Tables 3 and 4; only the C2 of AZ121 appears to be 5 mm longer than the C2 of the fossil KNMER 3205). Extant Giraffa (oldest animal): C2: 270 mm, C5: 240 mm, C7: 192 mm. Fossil Giraffa: C2: 265 mm, C5: 256 mm, C7: 255 mm. A comparison focussing particularly on that large C7 would have been especially captivating (unlike Badlangana et al. and Harris, I surmise so far that – due to its enormous difference to the C7 of the extant *G. camelopardalis* – there appears to be the possibility that it came from a different fossil individual, which perhaps a DNA-test could decide).

Back to the punctuated scenario: So, there would be an increase of about 0,2 mm per generation and very similar questions like those for the microevolutionary scenario may be raised: Hence, are there actually decisive selective advantages for the survival of giraffe populations of about 0.2 mm higher in each generation? And that for about almost 3000 or so generations each reaching ca. 0.2 mm higher than their ancestors into the canopy of the last leaves during a dearth? And now on this background of some 3,000 to 500,000 giraffe generations (leading only to *P. germaini*) Prothero and Solounias seem to point to a so far somewhat doubtful “*classic transitional form*” (f. 14.15): a giraffe fossil with an intermediate-length neck, longer than that of the okapi and the other extinct forms but shorter than that of the living giraffes” (p. 316) of probably just 1 generation, the neck of which fossil *prima facie* appears to be similar to the necks of *P. germaini* and the *Samotherium* species – with all the questions of pp. 23-26 left unanswered. And the number of the generations from something like *P. primaevus* via *P. germaini* and *Samotherium africanum* to *G. camelopardalis* would perhaps have to be doubled to about 6,000 to 1,000,000 generations (ignoring all the possible time overlaps of p. 45, including that of *P. primaevus* and *P. germaini*). **But now Prothero knows “exactly how it happened”?** Moreover, I would like to remind the reader of the basic problem mentioned on pp. 76/77: If *Samotherium* is derived from *P. germaini* – why then are almost all the calculated values for *P. germaini* given by Badlangana et al. (2009, Table 4, p. 740) based on that one C6 – larger than the values determined for *Samotherium boissieri/sinense*?

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Further reading:

Jonathan Witt (2023): [Evolution’s Tall Tale — The Giraffe Neck](https://scienceandculture.com/2023/03/evolutions-tall-tale-the-giraffe-neck/)

<https://scienceandculture.com/2023/03/evolutions-tall-tale-the-giraffe-neck/>

Wolf-Ekkehard Lönnig (2005/2007): [Nobelpreisträger pro Intelligent Design \(ID\) des Universums und des Lebens](https://www.weloennig.de/Nobelpreistraeger.pdf) [Nobel Laureates pro Intelligent Design of the Universe and Life. Includes many citations in English]

<https://www.weloennig.de/Nobelpreistraeger.pdf>

<https://www.weloennig.de/Nobelpreistraeger1a.html>

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Calculation example for the Bar Chart above:

## How to calculate the neck length of a 'true intermediate'

The neck length of a potentially ‘true intermediate’ species ( $l_I$ ) equals the mean value of the neck lengths of the okapi ( $l_O$ ) and the giraffe ( $l_G$ ). This mean value is the sum of both values divided by two.

$$l_I = \frac{l_O + l_G}{2}$$

For example: If the neck length of the okapi were 83 cm ( $l_O = 83 \text{ cm}$ ) and the neck length of the giraffe 215 cm ( $l_G = 215 \text{ cm}$ ), the neck length of a 'perfect intermediate' would be 149 cm ( $l_I = 149 \text{ cm}$ ).

$$l_I = \frac{83\text{cm} + 215\text{cm}}{2} = \frac{298\text{cm}}{2} = 149\text{cm}$$

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