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Comment

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With fascination we read a recent paper in *Biology Letters*, in which Braddy *et al.* (2008) report the find of a 46 cm long claw (chelicera) of the pterygote eurypterid *Jaekelopterus rhenaniae* from the Early Devonian Willwerath Lagerstätte of Germany, the largest claw ever found from arthropods. The authors conclude that this claw belonged to the largest arthropod fossil ever discovered and estimate the body length of the animal to be approximately 250 cm long based on extrapolations of scaling relationships of two other Silurian eurypterids (*Acutiramus* and *Pterygotus*).

In the introduction, the authors state that the body size of eurypterids, of which only chelicerae or remnants thereof have been found, was estimated based on the relative proportions of body length and free ramus. The described fossil consists of 'two disarticulated distal-most podomeres', meaning that no other part of the body was discovered so far.

The authors estimate the large size of the newly discovered *J. rhenaniae*, using the scaling relationships of smaller animals. With this they assume that all pterygotid eurypterids have the same isometric scaling relationship of their appendages, as Taylor (2001) demonstrated for chelipeds of extant decapods. But then the authors describe that 'Compared with chelicerae of smaller *Jaekelopterus* specimens, the largest denticles, especially in the free ramus, demonstrate a positive allometric growth'. If the denticles show positive allometry (following the suggestion of Bush & Allman (2004), we will refer to this scaling relationship as hypermetry), then it is possible that not only the denticles but also the entire chelicerae had a hypermetric scaling relationship. In this context, it is striking that the largest isolated coxa discovered of the same species suggests a maximum body length of only 180 cm (Stormer 1936).

The following two points should illustrate the caveats of estimating body size based on appendage size, assuming isometry without taking into account the quite common occurrence of exaggerated intra- and interspecific scaling relationships in arthropod groups:

(i) Numerous extant arthropod species reveal intraspecific scaling relationships of body appendages that vary with body size (Emlen & Nijhout 2000). The appendages either become more exaggerated as body size increases (increasing scaling coefficient) or reveal a discontinuous scaling relationship (biphasic scaling coefficient). Examples are the horns of the dung beetles in the genus *Onthophagus* (Coleoptera: Scarabaeidae; Emlen & Nijhout 2000). Here, the size of the horns of larger animals is out of proportion compared with those of smaller animals. Unearthing a fossilized horn of a large specimen would lead to exaggerated estimations of the actual body size, if complete fossils were only known from small representatives of the group and if a common isometric scaling relationship is assumed.

(ii) Some members of a taxonomic group reveal exaggerated dimensions of body parts, particularly appendages (Emlen & Nijhout 2000). The giant claws of fiddler crabs (*Uca* spp.) demonstrate that not all decapods follow the common interspecific scaling relationships that were found by Taylor (2001). Other examples are the extremely long legs and antennae of harlequin beetles (*Acrocinus longimanus*, Coleoptera: Cerambycidae). The discovery of an appendage alone would certainly lead to wrong conclusions about the body size of its possessor, if the body size estimation was based on the regular scaling relationship of closely related species.

To corroborate the assumption of a constant chelicerae size to body length ratio (=isometry), the authors could have presented a scaling equation between both parameters determined from the existing fossil records of pterygotids. Although more informative, this would still not eliminate the possibility that giant pterygotid eurypterids might have claws with discontinuous or exaggerated scaling relationships. Instead of reporting a single size estimate, it might be safer to report a range of possible sizes and explain possible sources of uncertainty (such as discontinuous or exaggerated scaling relationships) that underlie this range of sizes. We understand that palaeontologists have to work with a limited number of specimens, but it is exactly the insufficiency of available data that mandates a more cautious prediction/estimation of body sizes, unless it can be verified by the discovery of tracks or fossilized fragments of the body. In the end, the discovery of the largest isolated chelicera 'considerably extends the known upper size' only of the chelicerae 'attained by arthropods'.

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The accompanying reply can be viewed on page 281 or at http://dx.doi.org/doi:10.1098/rsbl.2008.0116.

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