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## **Review of Brandon Meter's dissertation thesis submitted to the Faculty of Sciences of the Charles University of Prague**

Dear Sirs,

Brandon Meter has submitted his thesis entitled „**Lizard growth and the ontogeny of sexual size dimorphism**“ in order to receive the academic degree of a Doctor of Philosophy (PhD) in Zoology granted by the Faculty of Science of the well-recognised Charles University of Prague, Czech Republic.

The research theme of Brandon dedicated to the ontogeny of sexual size dimorphism (SSD) of lizards is modern and will never become out-dated or out of fashion. Particularly the mechanisms of vertebrate growth such as indeterminate vs. determinate growth trajectories recently received much new attention. Brandon's thesis constitutes the most recent comparative integrative analyses of the ontogeny of lizard SSD applying several experimental approaches successfully including a study of the expression patterns of steroid hormones and insulin-like growth factors. His model organisms constituted selected representatives of the attractive gekkonid genus *Paroedura* native to Madagascar. The two focus species *Paroedura picta* (PETERS, 1854) and *P. vazimba* NUSSBAUM & RAXWORTHY, 2000 apparently have been successfully adapted to the laboratory for several breeding generations. Ideally the two phylogenetically related species show a male- and a female-biased SSD.

The thesis of Brandon Meter starts with a summary introduction, a detailed layout of the study aims and a summary of the results and the discussion. Then three research chapters resembling accepted (2) and submitted (1) manuscripts close the thesis. The **first chapter** focuses on the energetical perspective of lizard growth in relation to life-history decisions such as maturity. The manuscript has been published in the Ideas & Perspectives section of the renowned evolutionary biology journal *EVOLUTIONARY ECOLOGY* printed by Springer Switzerland. In the paper Brandon perfectly laid out the rationale of his PhD-studies. Also, all the hypothesis he wanted to test empirically are

described in much detail. I particularly liked all the schematic illustrations of the models and the experimental designs, which makes it easy for the unexperienced but interested reader to follow. One apparent aim of the study was to further explore the determinate nature of growth in lizards, and to concentrate the efforts to the role of the individual energetical budget during growth and ontogeny facing the classic trade-off between growth and maturity maybe playing a key role in the expression of SSD.

In the **second chapter** the development of the male-larger SSD of *Paroedura picta* is further explored. The research paper has been already published in the open access *FRONTIERS IN PHYSIOLOGY* [apparently the most cited topic journal in the field]. Brandon and his co-workers followed the growth of both sexes of *Paroedura picta* but also monitored the activity of bone growth plates, gonad size, levels of steroid levels, expressions of major growth receptors and gene expression of the insulin-like growth factor network. The experimental design follows the lay-out of Meter et al. (2020), but I think the design is agreeably the best possible comparative and integrative way to study SSD and ontogeny. A major outcome of the study was the detection of a significant peak in the expression of IGF in male geckos at early age close to maturity. The study suggests that SSD in male-larger lizards is likely related to a positive effect of high IGF levels on bone growth.


The **third chapter** deals with the complex ontogeny of sexual size dimorphism in the female-larger *Paroedura vazimba* showing determinate growth. The manuscript has been submitted to the well-established Evolutionary Developmental Biology Journal *EVOLUTION AND DEVELOPMENT* printed by Wiley. I keep fingers crossed, that the manuscript will be accepted and published soon. Brandon and his colleagues monitored postembryonic growth over 15 months in *Paroedura vazimba*. Female hatchling grew faster than males but also attained their determinate final body size earlier than males.

In summary the thesis of Brandon Meter's is of highest quality. I find all three research chapters will have a major impact for our understanding of the mechanisms of vertebrate growth patterns related to the expression of sexual size dimorphism in ectothermic vertebrates.

Herewith I declare that the thesis is satisfactory, and I strongly recommend Brandon Meter's thesis for defence to finally receive the degree of a PhD in zoology.

Sincerely

Alexander Kupfer

  
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