



Fakulta rybářství
a ochrany vod
Faculty of Fisheries
and Protection
of Waters

Jihočeská univerzita
v Českých Budějovicích
University of South Bohemia
in České Budějovice
Czech Republic

**Opponent's Report on the Doctoral Dissertation of Abhipsa Panda, M.Sc.,
entitled "A Journey Towards Identification of Paternal-Effect Genes and
Exploration of Their Roles During Early Life Stages in Eurasian Perch, *Perca
fluviatilis*."**

***1) Assessment of whether the dissertation demonstrates general theoretical
knowledge in the discipline***

The dissertation presents a well-developed and up-to-date theoretical framework in the field of paternal influences on early development, with particular emphasis on non-genetic inheritance, sperm-mediated effects, and transcriptomic regulation in fish. The author demonstrates a strong command of contemporary literature on epigenetic, molecular and physiological paternal factors, as well as on methodological approaches used to analyze early developmental processes.

The conceptual introduction of paternal-effect genes (PEGs) is explained clearly at the beginning of the thesis, where the author defines PEGs as genes in the offspring whose expression is modulated by non-genetic paternal factors without changes to the inherited DNA sequence. This demonstrates a solid understanding of the molecular and developmental principles relevant to the dissertation topic.

In one later section, written in the context of sperm cryopreservation, the author expands this definition by stating that PEGs may be influenced by both genetic and non-genetic sperm factors. Although this broader formulation is understandable considering potential DNA damage occurring during cryopreservation, it introduces a slight terminological inconsistency with respect to the initial, strictly non-genetic definition. Nevertheless, this inconsistency does not undermine the author's overall theoretical competence; it merely indicates a place where conceptual clarification could strengthen the internal coherence of the thesis.

In summary, the dissertation meets the requirement of demonstrating extensive and well-grounded theoretical knowledge.



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2) Assessment of whether the dissertation demonstrates the ability to conduct independent scientific work

The dissertation presents a coherent research design, a logical link between hypotheses, methods, results, and interpretation. The author applies a well-structured experimental framework that includes manipulation of sperm condition (cryopreservation, post-thaw treatment) and comparisons between wild and domesticated males, combined with phenotypic assessment and RNA-seq transcriptomics.

The methodological choices are appropriate for the research questions, and the author demonstrates competence in managing complex datasets and applying bioinformatic analyses. The ability to integrate phenotypic and transcriptomic results further confirms scientific maturity and independence. The interpretation of results is thoughtful and critical, acknowledging the limitations inherent in distinguishing genetic from non-genetic paternal influences, particularly in the comparison between wild and domesticated males.

Therefore, the dissertation convincingly demonstrates the candidate's ability to conduct independent scientific research.

3) Assessment of whether the dissertation provides an original solution to a scientific problem

The work addresses a timely and scientifically significant question: how paternal sperm condition affects early offspring development through non-genetic pathways. This is an emerging field with limited empirical evidence, particularly in fish. The dissertation contributes original findings showing that altered sperm physiology—through cryopreservation or differences associated with domestication—can shape early larval phenotype and gene expression.



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The author's introduction of a functional category of paternal-effect genes (PEGs) as transcriptomic markers responsive to paternal influences represents an original conceptual contribution. Despite the aforementioned minor inconsistency in wording, the operational framework is innovative and useful for interpreting paternal effects in non-genetic contexts.

The integration of phenotypic and transcriptomic datasets provides new insight into the spectrum and magnitude of paternal influences, reinforcing the originality of the work. The use of both domesticated and wild males adds an additional dimension by illustrating how long-term environmental and selective histories modulate paternal contributions.

The dissertation therefore constitutes an original scientific contribution addressing a relevant and insufficiently explored biological problem.

Final overall assessment

All three required criteria are positively fulfilled:
the dissertation demonstrates solid theoretical knowledge,
shows the candidate's capability for independent research,
and presents an original solution to an important scientific problem.
Accordingly, the dissertation merits a positive overall evaluation.

In Vodňany, 8 December 2025

doc. Ing. Martin Pšenička, Ph.D.