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Promotionsverfahren von **Herrn M.Sc. Jürgen Wilhelm Schönborn**
Auslage der Dissertation und Gutachten sowie Termin der mündlichen Prüfung
Anlage: Einseitige Zusammenfassung der Dissertation

Sehr geehrte Damen und Herren,

in dem oben genannten Promotionsverfahren wird die Annahme der Dissertation

The importance of resource allocation for the development and physiology of multicellular organisms

von den Berichterstattenden Dr. M. Beller und Prof. Dr. O. Ebenhöf beantragt. Sie kann zusammen mit den
Gutachten in der Zeit

vom 31.10.2024 bis 11.11.2024

eingesehen werden. Bitte wenden Sie sich zur Einsicht an das Promotionsbüro (promotionmnf@hhu.de).

Einsprüche gegen diese Dissertation können nur zwei Tage nach der vorgenannten Frist
geltend gemacht werden. Erfolgt kein Einspruch, so gilt die Dissertation als angenommen
(§ 7 Ziffer (5) PO).

Sofern die Dissertation angenommen wird, findet die mündliche Prüfung am

14.11.2024 um 13:00 Uhr

im **Hörsaal 6A** statt. Als Prüferinnen bzw. Prüfer sind vorgesehen:

Prof. Dr. I. Axmann, Prof. Dr. S. Fraune und Prof. Dr. T. Klein.

Die Öffentlichkeit ist bei der Befragung nicht zugelassen.

Mit freundlichen Grüßen
im Auftrag

Daniela Schleiffer

The importance of resource allocation for the development and physiology of multicellular organisms

Jürgen Wilhelm Schönborn – Abstract

The metabolism of an organism contains physico-chemical processes in which substrates are converted into metabolic intermediates, known as metabolites, and turned into essential cellular components or energy. Resource allocation in multicellular organisms determines the distribution of substrates to critical metabolic processes. These metabolic processes stand in constant competition with each other, resulting in the inability to optimize all metabolic processes simultaneously. Understanding resource allocation in multicellular organisms enables us to understand survival strategies and the impacts of metabolic diseases. Yet, even fundamental design principles remain unclear.

The aim of this work was to investigate the influencing factors on resource allocation in multicellular organisms. For this purpose, biochemical measurements and metabolic flux analyses using Flux Balance Analysis were performed. Specifically, the growth and development of *Drosophila melanogaster* larvae were investigated to achieve a better understanding of resource allocation. These studies revealed the effects of different growth conditions on development and resource allocation. The larval development can be accelerated by the addition of different metabolites, such as certain amino acids. These additional metabolites directly affect underlying metabolic processes and their prioritization. This effect of additional resources on development and metabolism were further investigated through larval microbiome interaction studies. It was observed that secreted metabolites influenced the metabolism of individual members of the microbiome. This can potentially affect the metabolism of the multicellular host organism through secreted metabolites of the microbiome.

Furthermore, physiological studies of larval organs, such as the gut, have an impact on the resource allocation of developing larvae. These studies revealed that the gut, and more likely other organs, play an important role in determining critical developmental stages, such as the pupation, and regulate metabolic processes in multicellular organisms.

In this thesis, it was possible to present findings that advances the understanding of resource allocation and the impact of physiological properties on the metabolism of a multicellular organism.