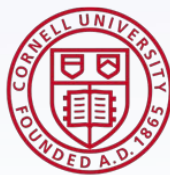




Jockey Club College of Veterinary
Medicine and Life Sciences

香港城市大學
City University of Hong Kong
in collaboration with Cornell University



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Fecal Metabolome of Chicken Fed Black Soldier Fly and Yellow Mealworm-Based Diets

Ákos Kenéz¹, Ilaria Biasato², Laura Gasco²

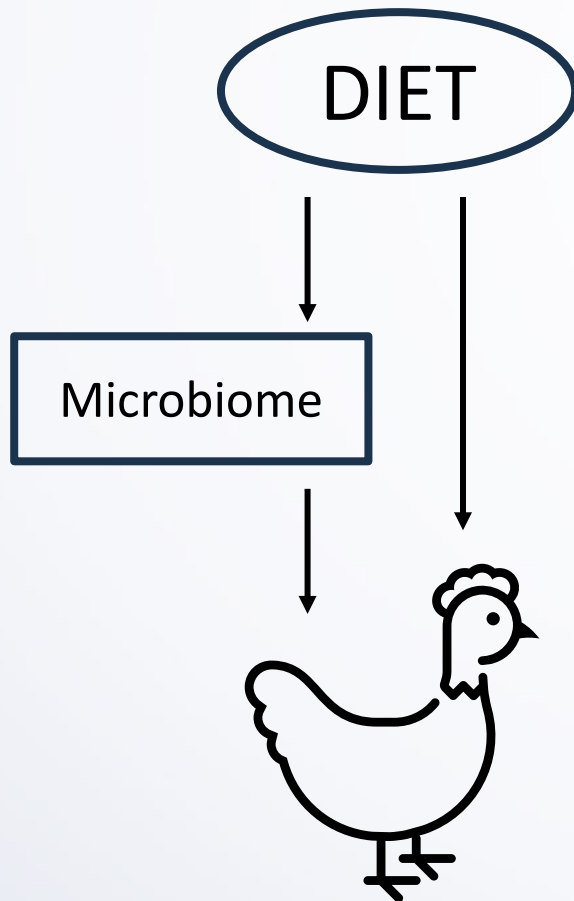
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Background



Journal of Insects as Food and Feed, 2020 online

SPECIAL ISSUE: *Advancement of insects as food and feed in a circular economy*

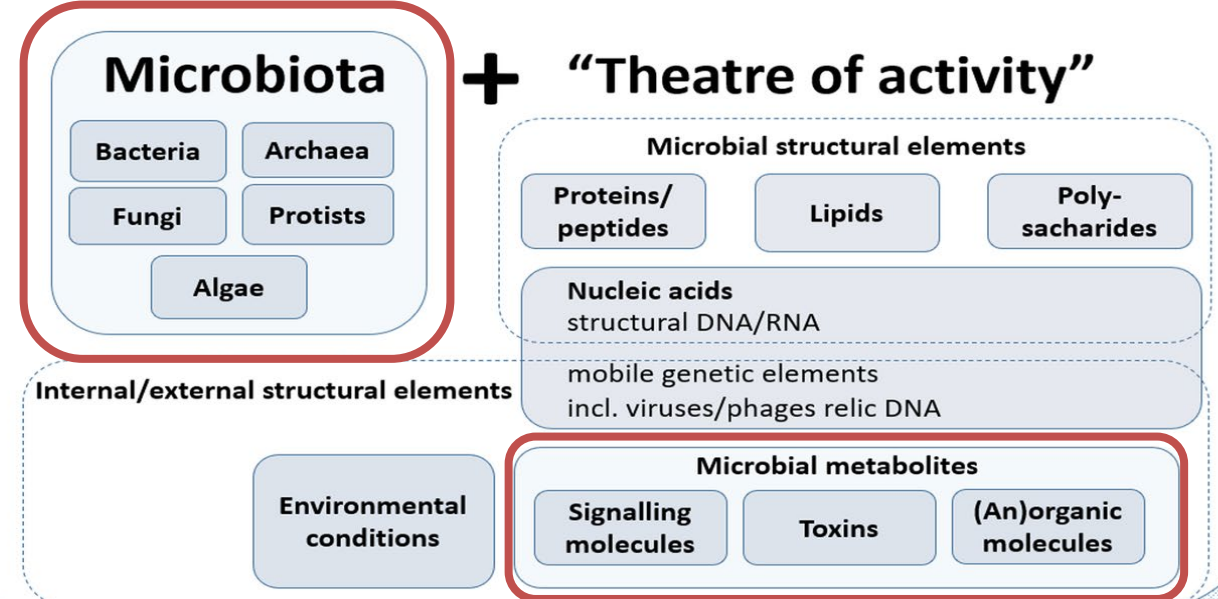


Beyond the protein concept: health aspects of using edible insects on animals

L. Gasco^{1*}, A. Józefiak² and M. Henry³

Berg et al. 2020, BMC Microbiome

Microbiome



Biome: a reasonably well defined habitat which has distinct bio-physio-chemical properties

Hypothesis

HI: *Hermetia illucens*
TM: *Tenebrio molitor*

- Dietary inclusion of HI, TM, and HI+TM can modulate the intestinal microbiome of chicken, reflected by altered microbial metabolite concentrations in the cecum

Objectives

- Quantify and compare the cecal concentration of microbial metabolites in a metabolomics approach

Study design

- Ross 308 broiler chickens at the University of Turin
- Feeding trial from 1 days until 38 days of age
- Dietary treatments (n=6 pens, 2 chicken sampled in each pen)
 - Control
 - HI 5% or 10%
 - TM 5% or 10%
 - HI+TM mix 5% or 10%
- Sampling cecal content upon sacrificing

○	C
○	HI10
○	HI5
○	TM10
○	TM5
○	MIX10
○	MIX5

Metabolomics analysis



- TMIC Microbiome Metabolism (MEGA) Assay
 - Targeting 692 metabolites
- Fecal metabolite extraction
- LC-MS-based quantification (μM)



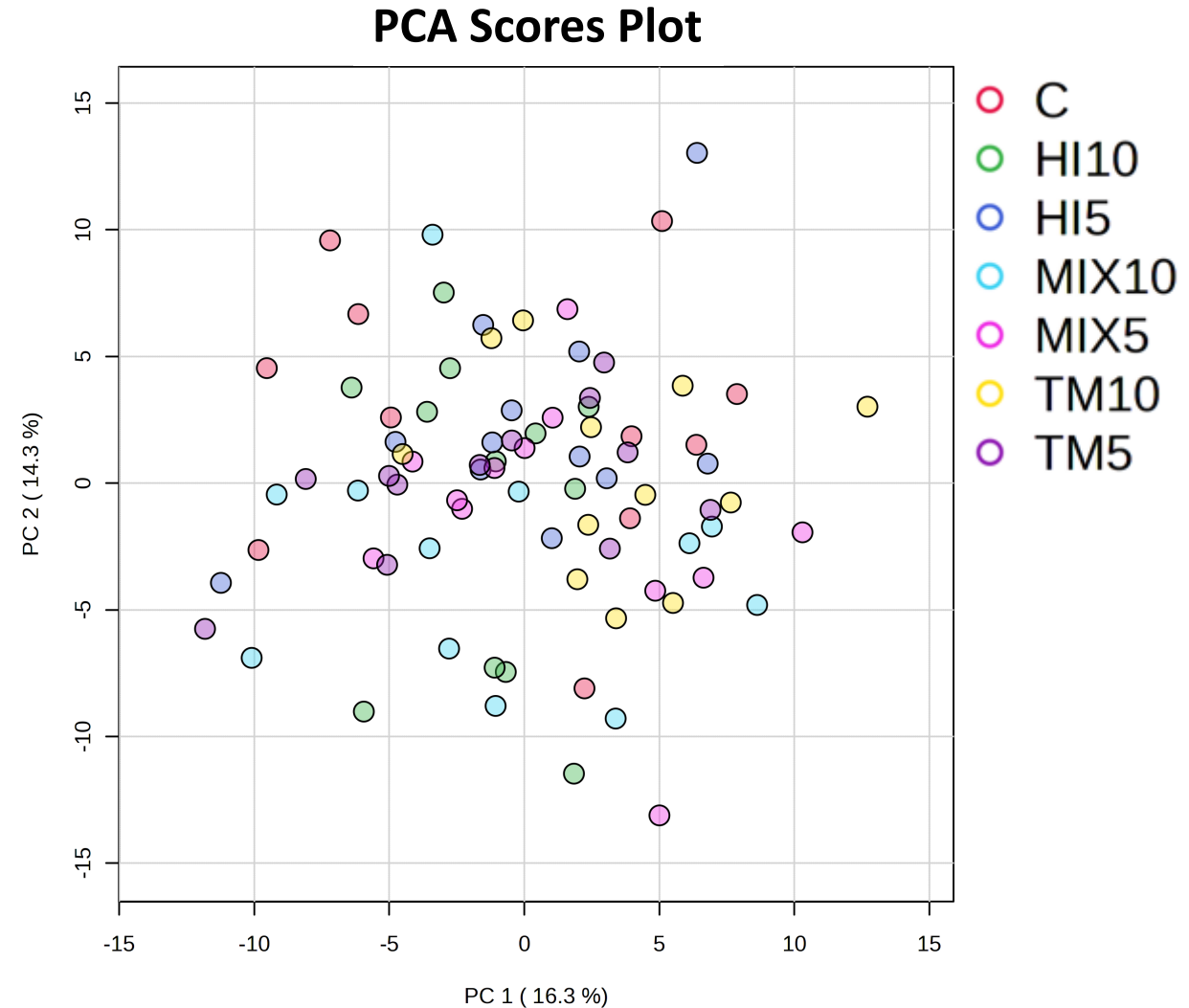
Metabolite Classes	# of Metabolites
Organic Acids	82
Amino Acids & Derivatives	56
Acylcarnitines	40
Biogenic Amines	34
Phosphatidylcholines	23
Nucleotide/Nucleoside	26
Indoles & Derivatives	11
Sphingolipids	10
Sugars	1
Others	5
Lipids (Phosphatidylcholines & Sphingolipids)	103
Lipids (Ceramides, Cholesterol esters, diacylglycerols)	89
Lipids (Triacylglycerols)	212

Statistics: MetaboAnalyst
– PCA and ANOVA



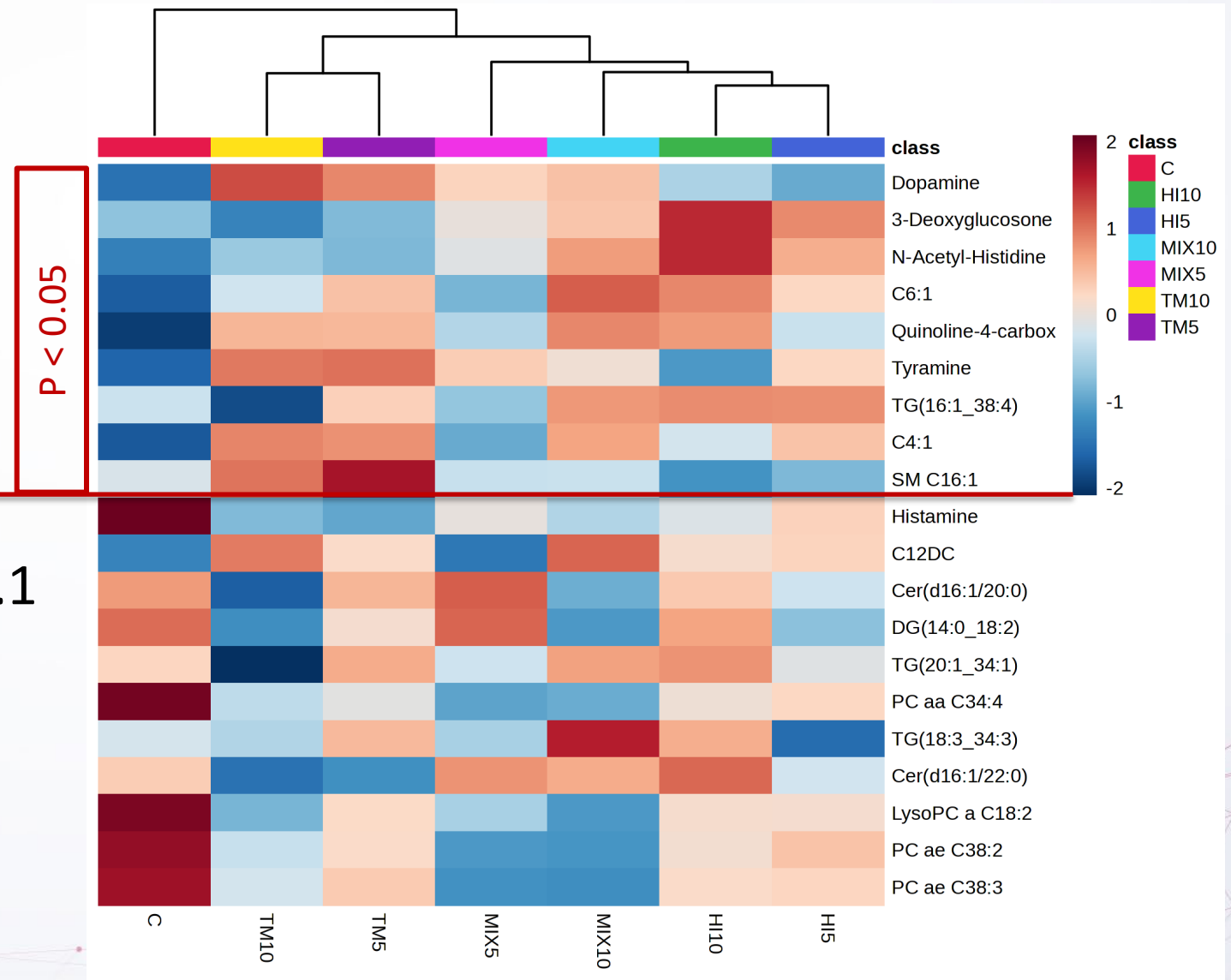
Results - Overview

- 601 features effectively quantified (<LOD excluded)
- Data log-transformed and Pareto-scaled
- PCA scores plot:
 - No major separation patterns associated with dietary treatments



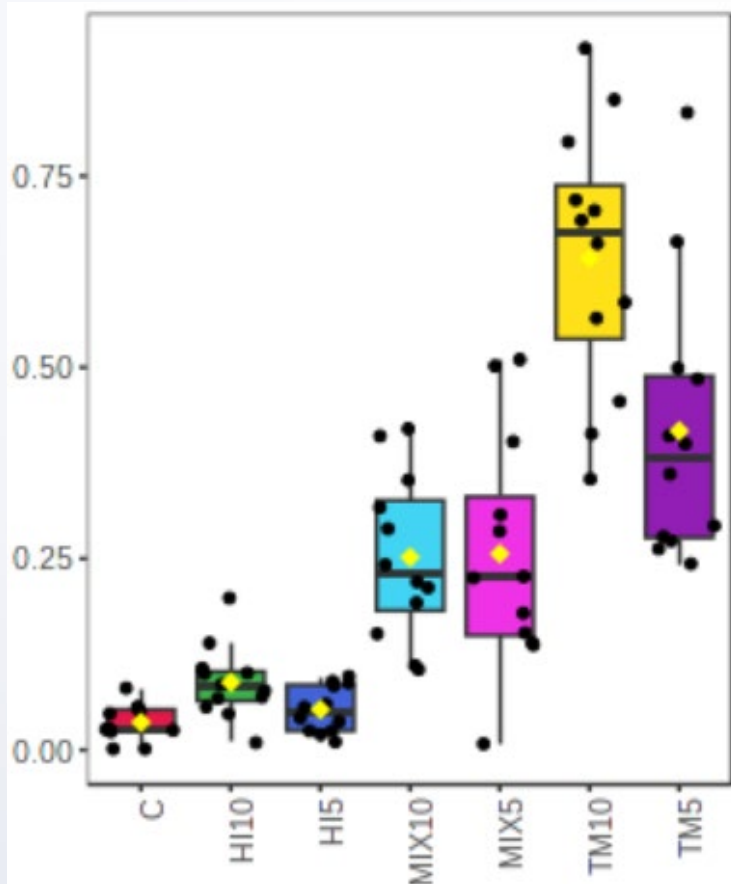
Significant metabolites across all treatments

- Heatmap of top 20 metabolites
- One-way ANOVA:
 - 9 metabolites $P < 0.05$
 - 4 metabolites $0.05 < P < 0.1$
 - [FDR corrected P values]

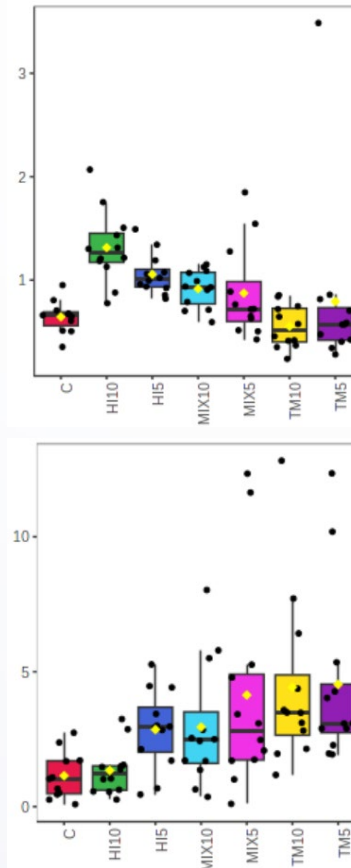


Significant metabolites across all treatments

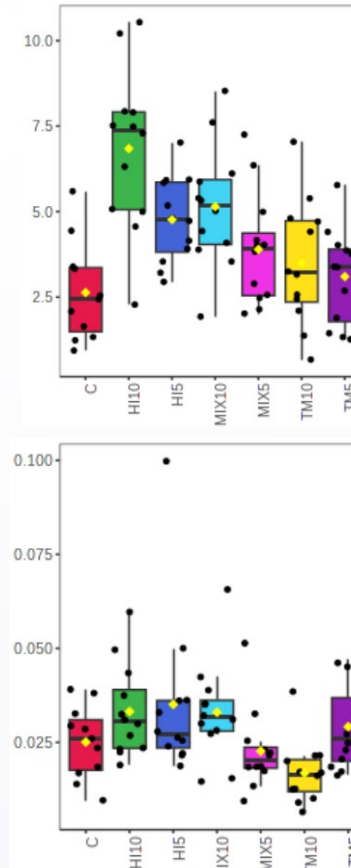
Dopamine



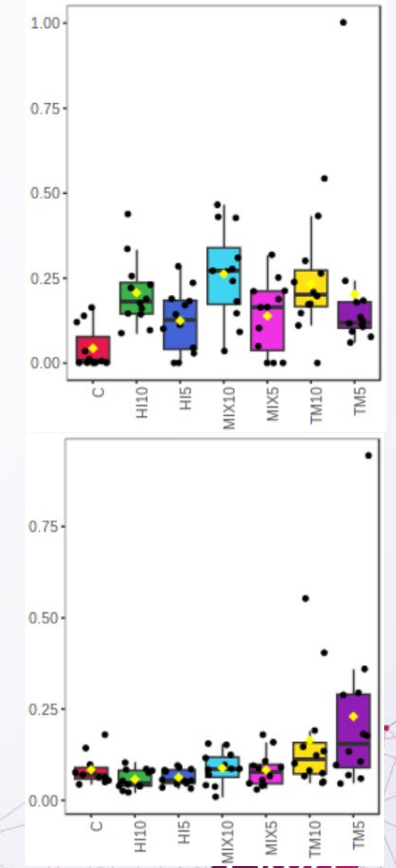
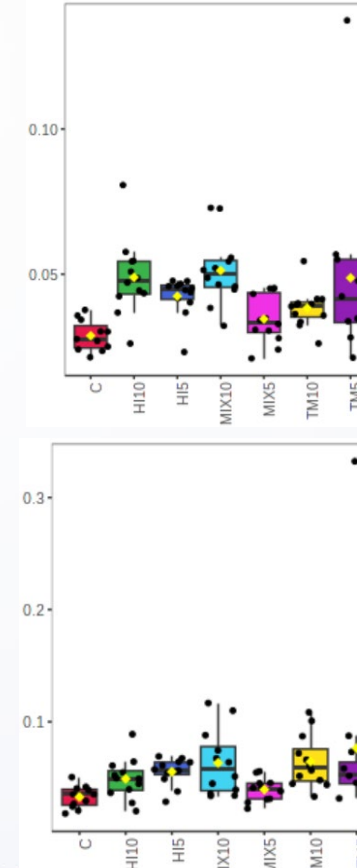
3-Deoxyglucosone



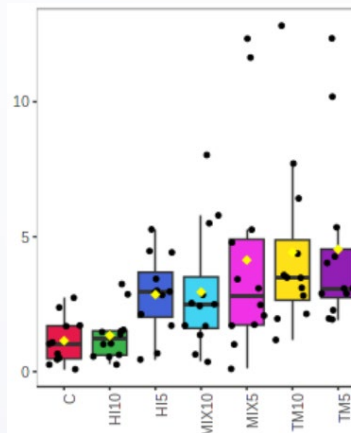
N-Acetyl-Histidine



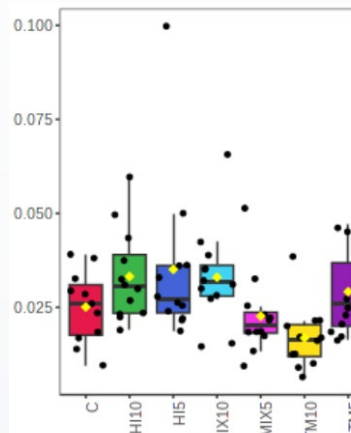
Hexenoylcarnitine Quinoline-4-carboxylic acid



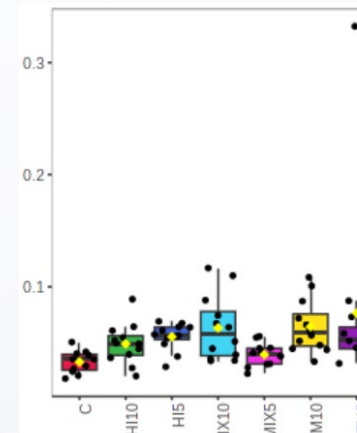
Tyramine



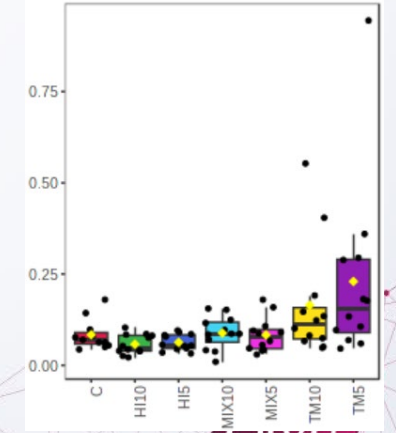
TG 16:1 38:4



Butenylcarnitine

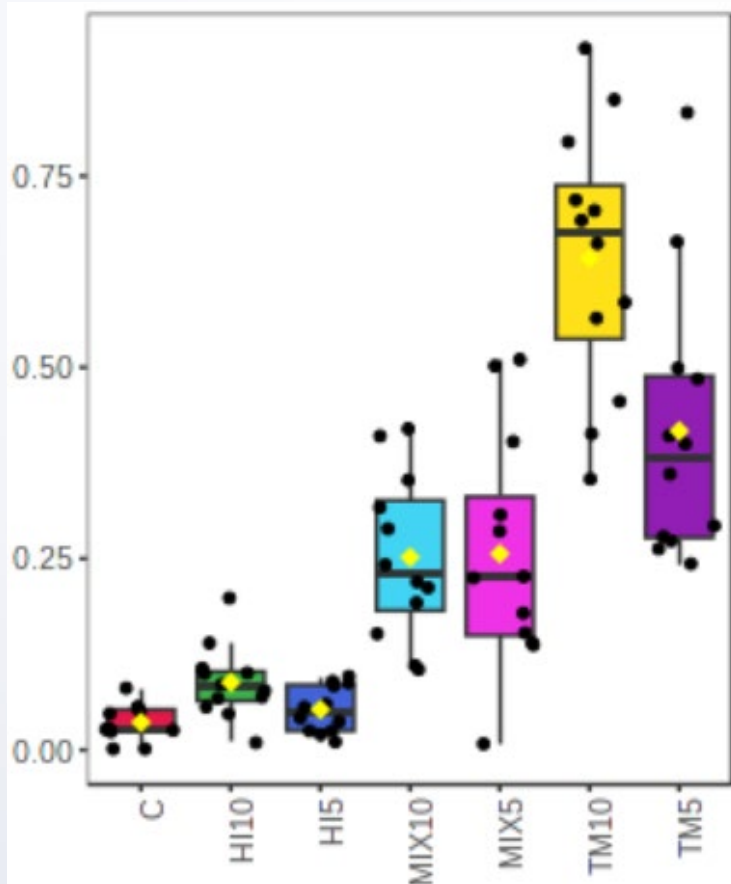


Sphingomyelin C16:1



Increased dopamine in TM treatments

Dopamine



© FEBS 2000

N-β-Alanyldopamine and Dopa decarboxylase

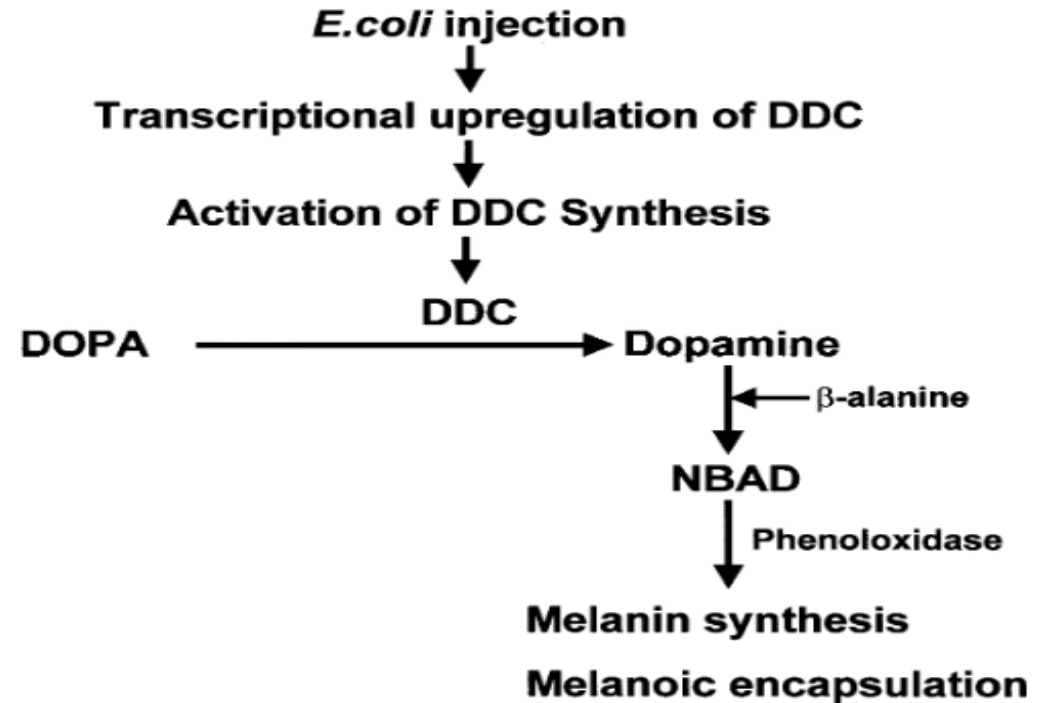


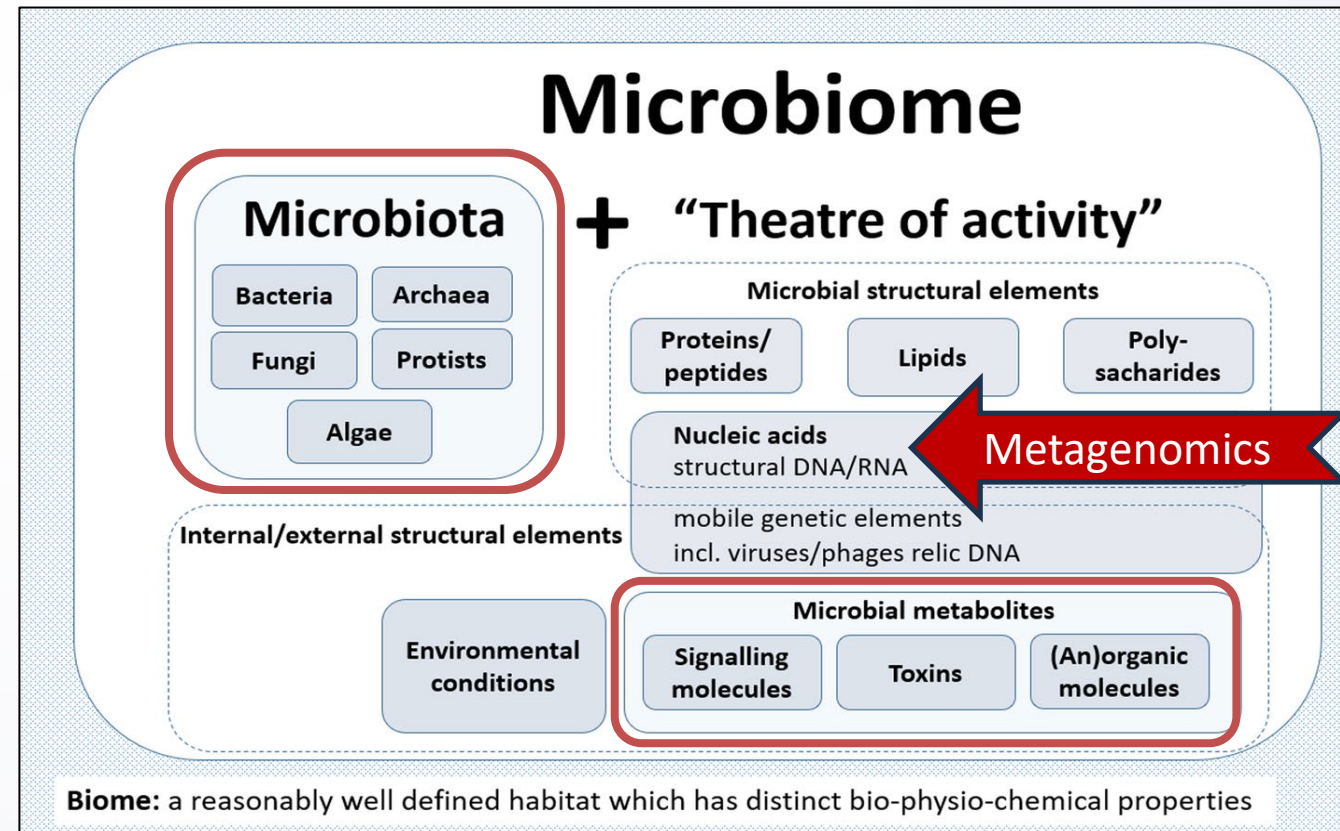
Fig. 9. Hypothetical scheme of NBAD and DDC induction in *Tenebrio* larvae by bacterial challenge.

Kim et al., 2000



Conclusions

- Insect-based diets associated with functional alteration in intestinal microbiome
 - Caveat: Microbial metabolites or feed-derived compounds
- Dopamine effect in GI
- Future work: Integrated microbiome
- Fecal metabolomics might help elucidate physiological effects of insect-based diets



Berg et al. 2020, BMC Microbiome



Thank you for your attention!

What questions do you have?