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# The juvenile hormone analogue, Pyriproxifen, alters the body composition of *Tenebrio molitor* larvae

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bioscience for the future

# Insects as an alternative protein source

## Why are we looking to insects?

Nutritionally
- Complete amino acid profile in many species
- Rich in vitamins and minerals

Environmentally
- Fewer greenhouse gases emitted
- Less water used to rear
- Vertical farming – reduced deforestation
- Reared locally – reduced air miles

Economically
- Can be reared on waste material or less valuable by-products

*Tenebrio molitor* larvae (TM)
"Yellow mealworm"

Caveat: Insect larvae can contain relatively high levels of fat

Can make feed formulation more difficult

# Juvenile hormone treatment on mealworms

**Study aims:**

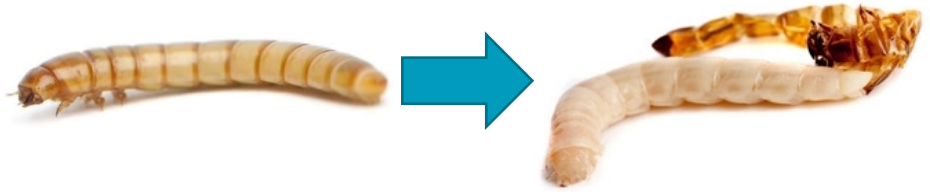
1. To investigate the possibility of manipulating body composition of yellow mealworms, *Tenebrio molitor*.
2. To determine whether body fat content can be reduced in *T. molitor* through feeding exogenous hormones

Juvenile hormone (JH)

- Naturally occurring hormone in holometabolous insects
- Involved in key processes in insects
  - Reproduction
  - Diapause
  - **Metamorphosis**

JH titre is maintained

JH present



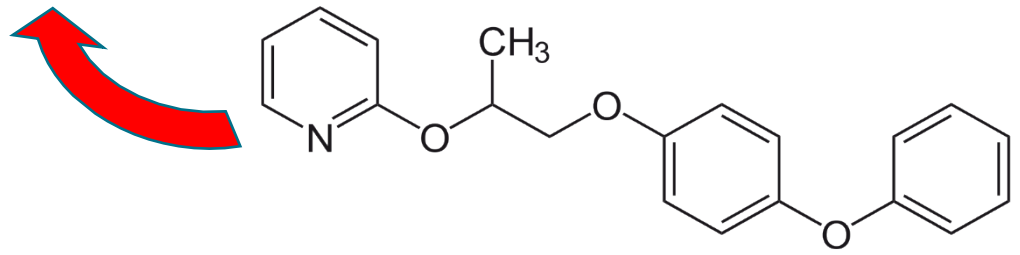
Larvae



Moulting

Pupae

Beetle (adult)




Pyriproxifen (JH analogue (JHA))

# Methods


## Feeding trial

Treatments:
- Acetone vehicle control group (Vcont)
- 2 mg/ kg pyriproxifen (JH-PL)
- 15 mg/kg pyriproxifen (JH-PH)

Replicates:
4 replicate trays/ treatment group

Mealworms:
300 TM/ replicate tray - 15-18 mm long (<6 weeks old)

Trial duration:
28 days

## Data collection

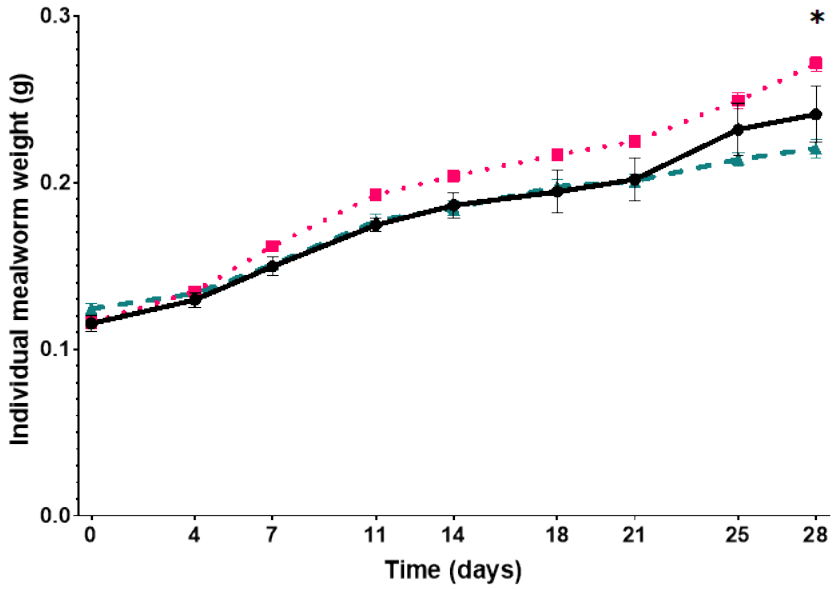
Growth/ life traits:
- Individual TM weight
- Pupation
- Survival

Nutrient analysis:
Samples freeze dried – 72 hours
Crushed into particles (< 1 mm)
- Crude protein content (Nitrogen analysis)
- Fat content (Soxhlet fat extraction)
- Protein analysis
  - SDS-PAGE
  - Amino acid analysis

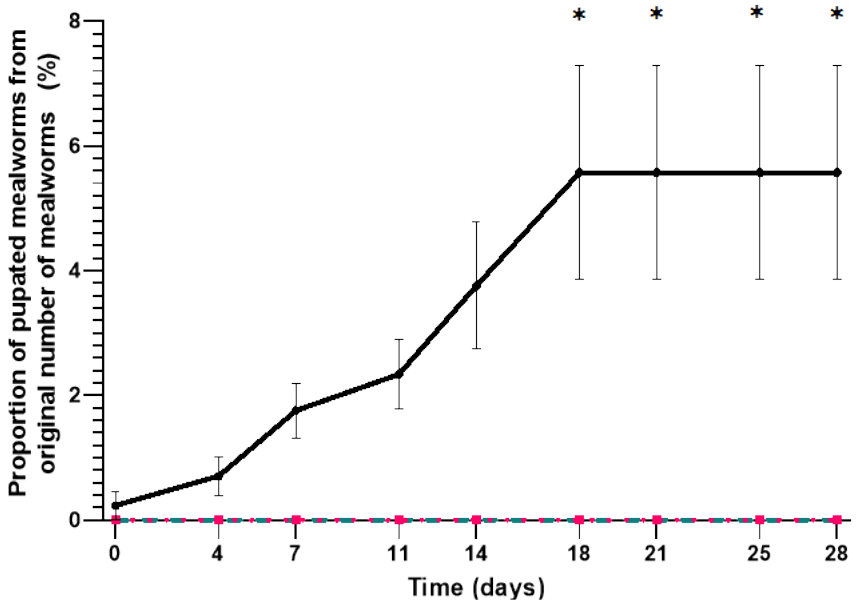
# Results – Growth/ life traits

Vcont JH-PL JH-PH

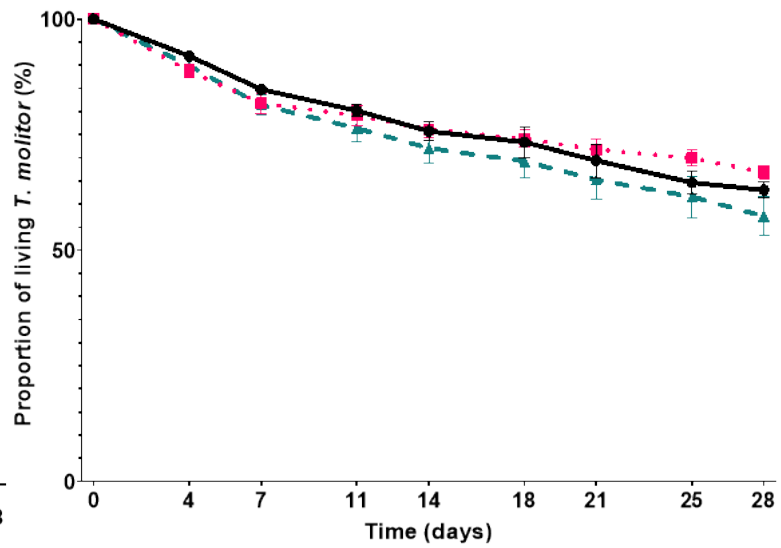
Individual MW weight




Pupation




Survival

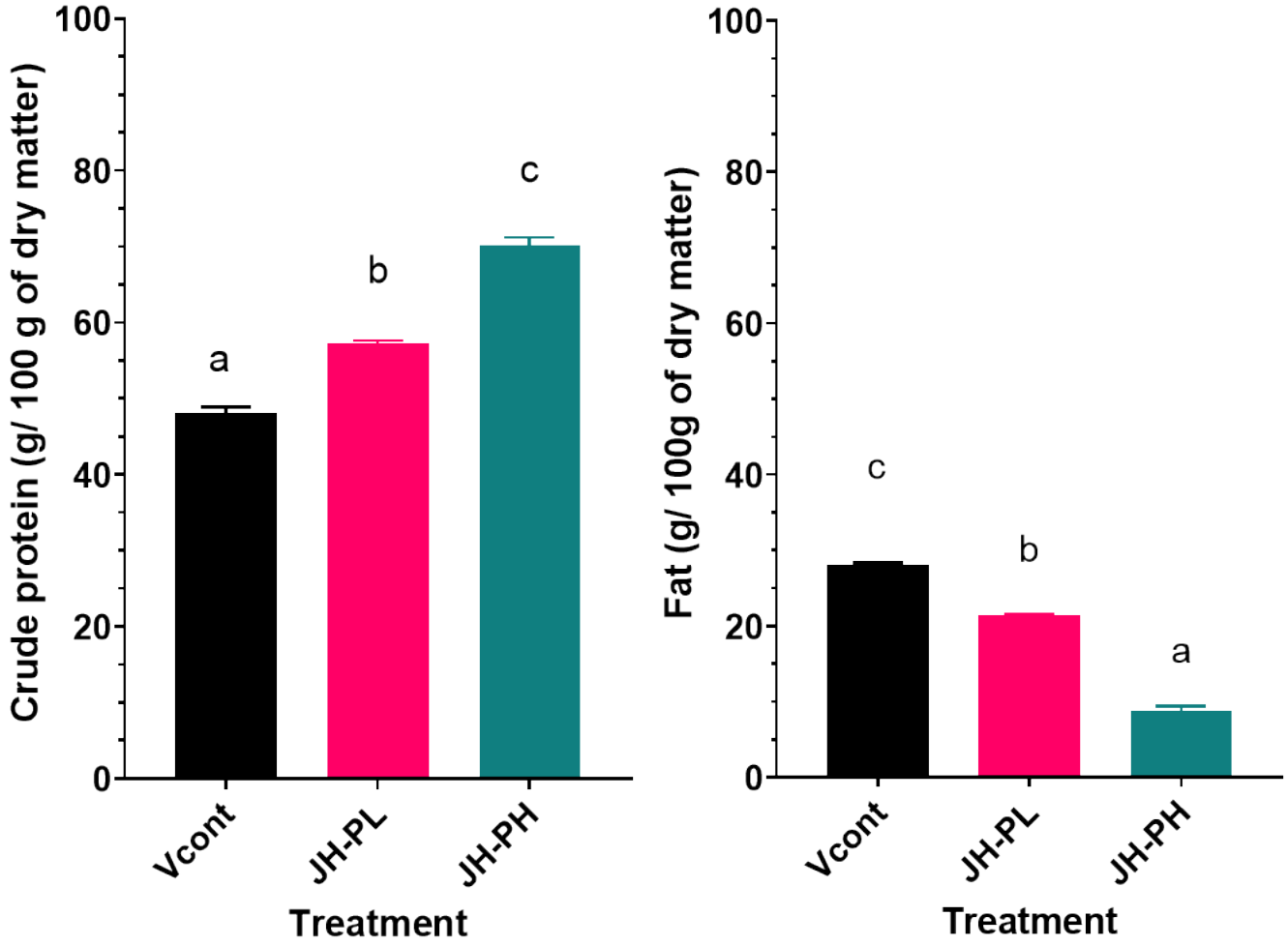



- Individual TM weight is greater in JH-PL than JH-PH by day 28, but no different than Vcont. (P<0.001)

- JHA treatment inhibited pupation.
- Vcont exhibited significantly higher pupation from day 18 (P<0.001)

- JH-PH survival is slightly reduced compared to Vcont and JH-PL (P<0.001)

# Results – Nutrient analysis



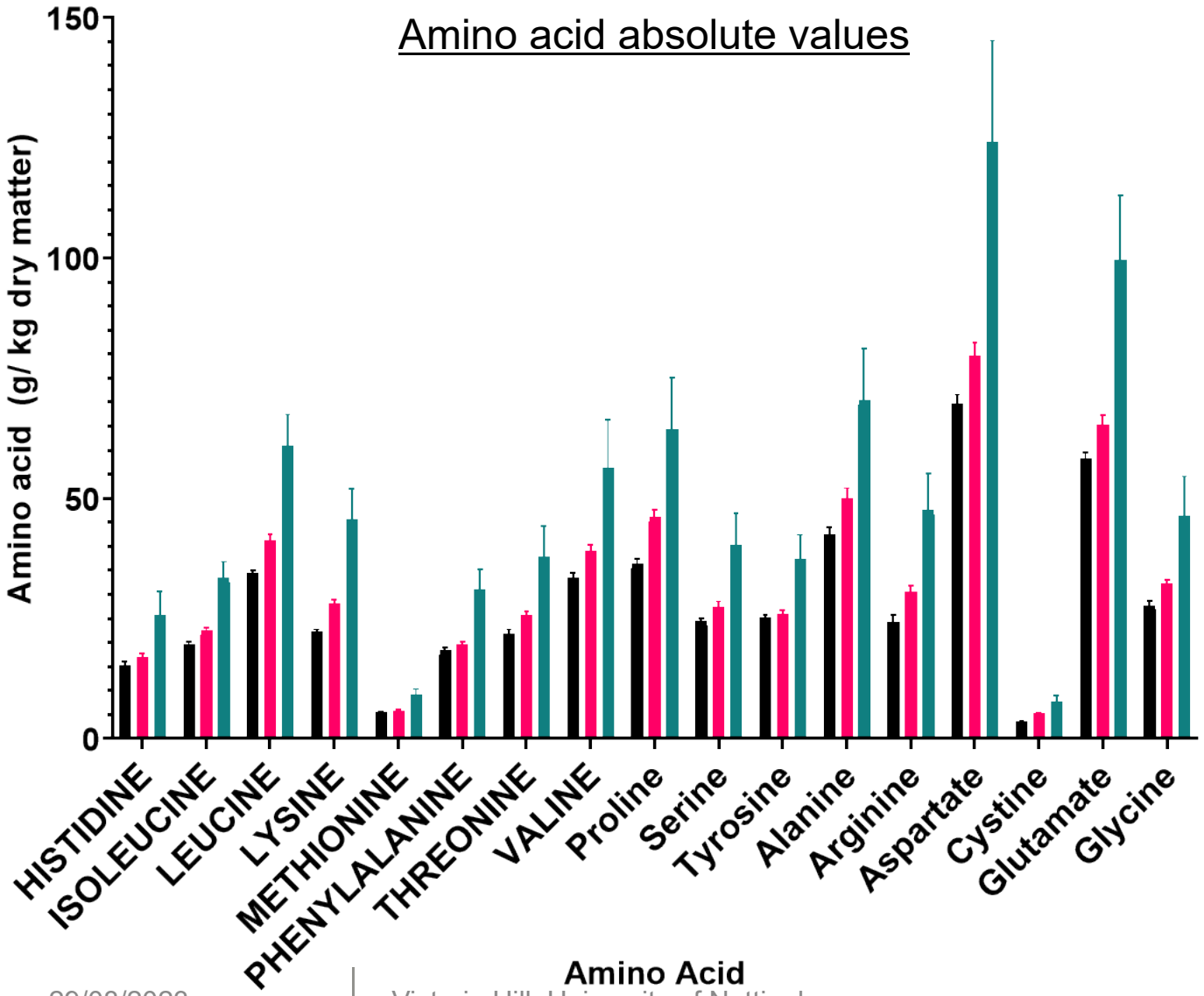




46% increase in protein in JH-PH TM compared to Vcont (P<0.001)

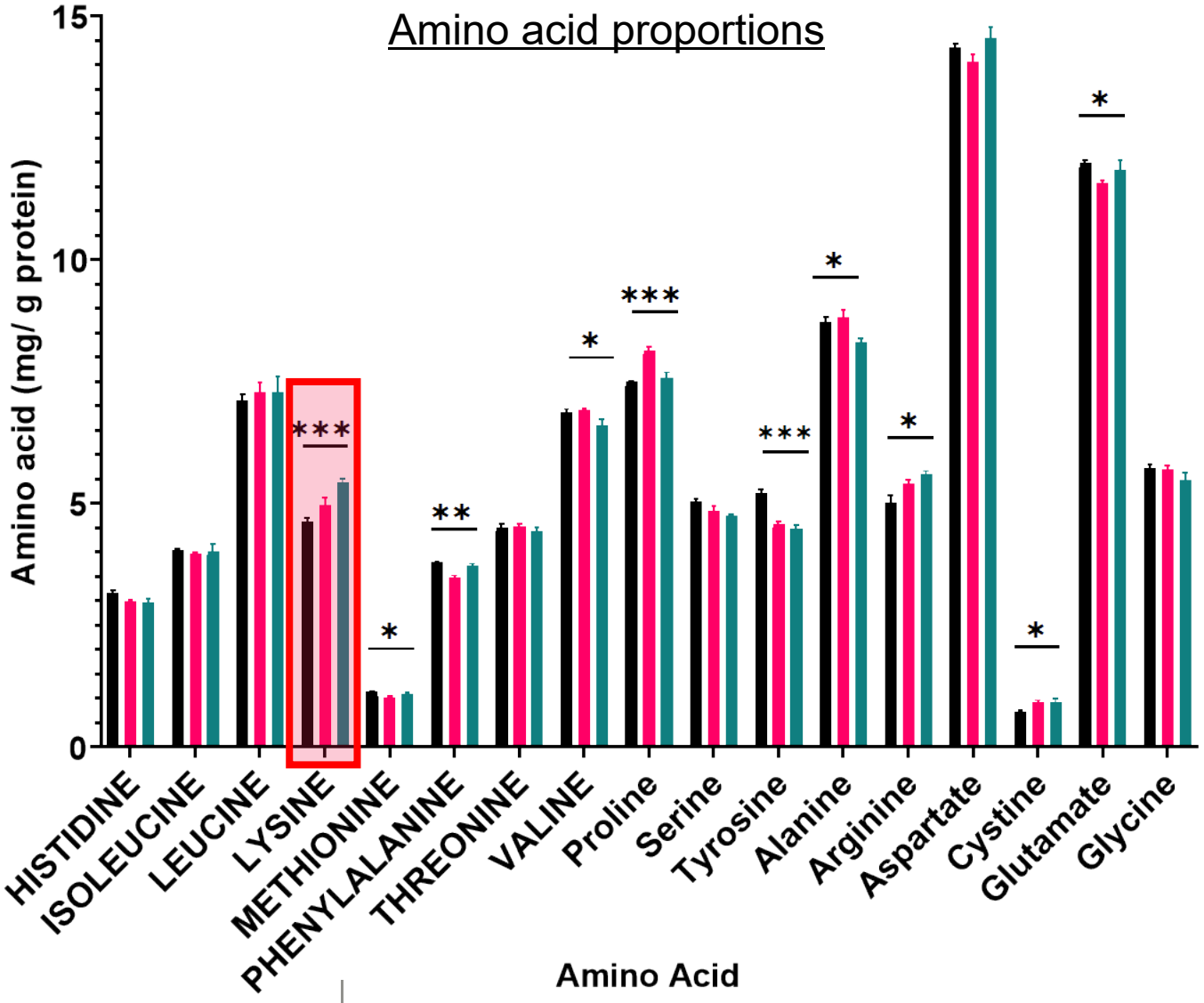
68% reduction in fat content in JH-PH compared to Vcont (P<0.001)

# Results – Nutrient analysis




Increase in all amino acids on dry matter basis with JH-PH ($P<0.001$)
Agrees with increase in crude protein

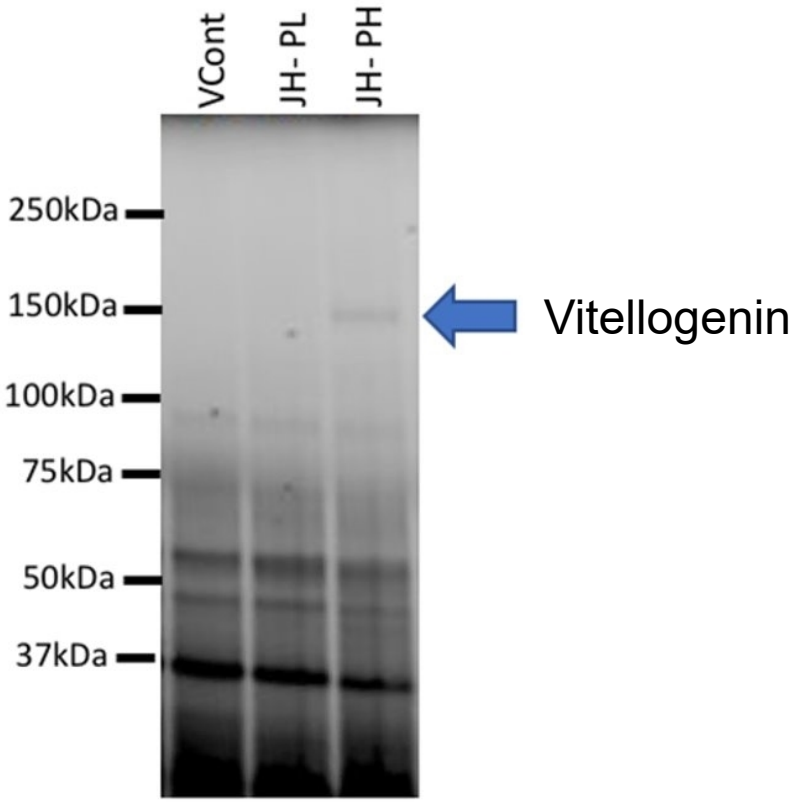
# Results – Nutrient analysis

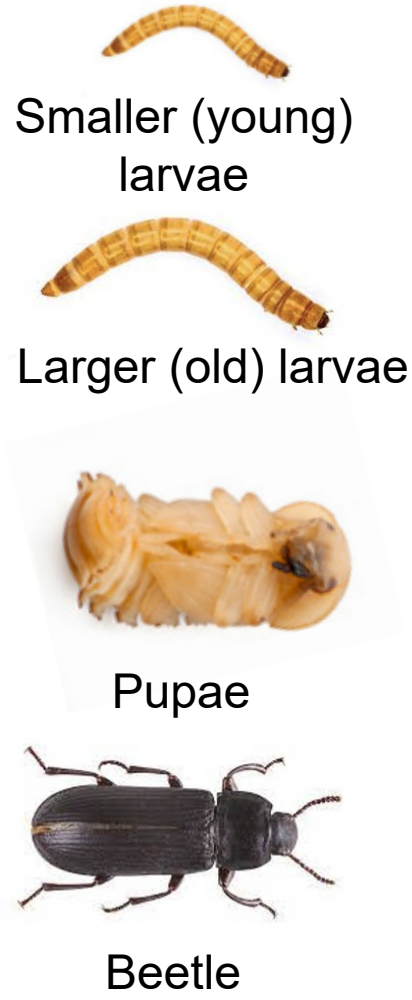


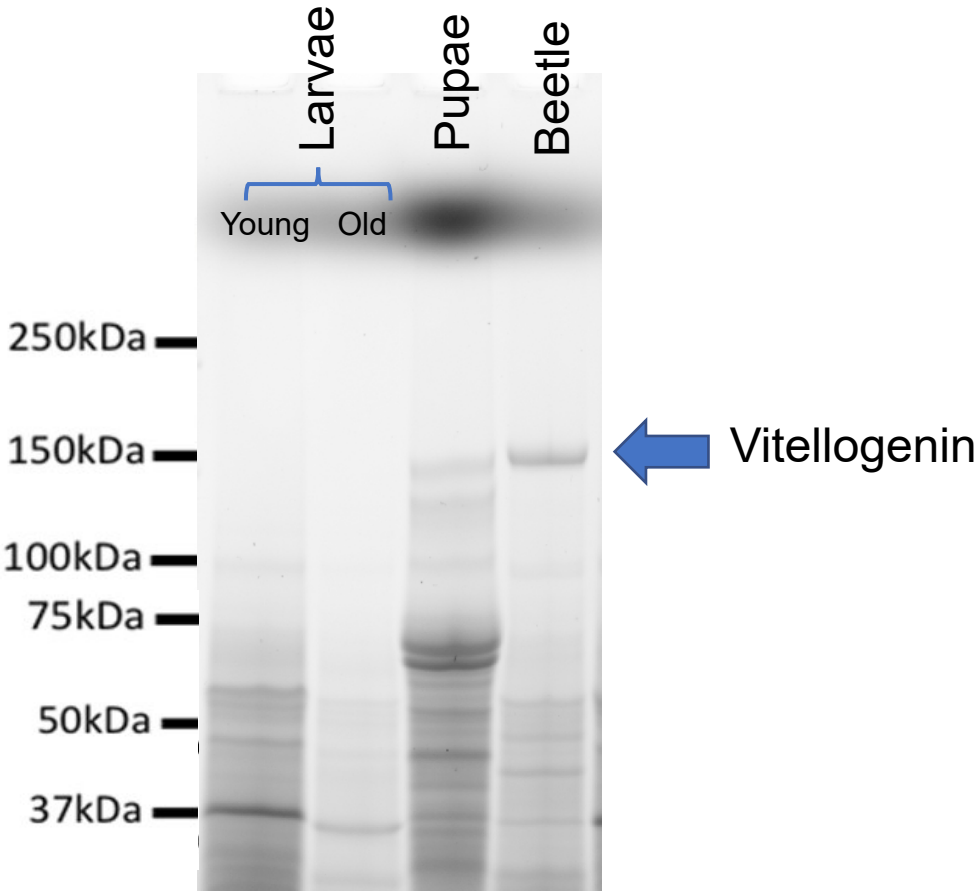

Marginal changes to amino acid proportions

17.5% increase in lysine content in JH-PH compared to Vcont (P<0.001)

# Results – Nutrient analysis




Band present in JH-PH TM, pupae and beetles identified as Vitellogenin (Vg)

# Summary

JHA treatment induces shift in body composition in TM

- 46% increase in crude protein content with JH-PH
- 68% reduction in fat content with JH-PH

Marginal changes in amino acid profile (mgAA/g protein), may be due to change of proteins expressed

- Induction of vitellogenin

*Increased protein synthesis or reduced lipid deposition?*

- Further work required to determine mechanism of composition change

**Key message: Mealworm body composition is highly dynamic and can be manipulated to increase nutritional content, beneficial to animal feed**

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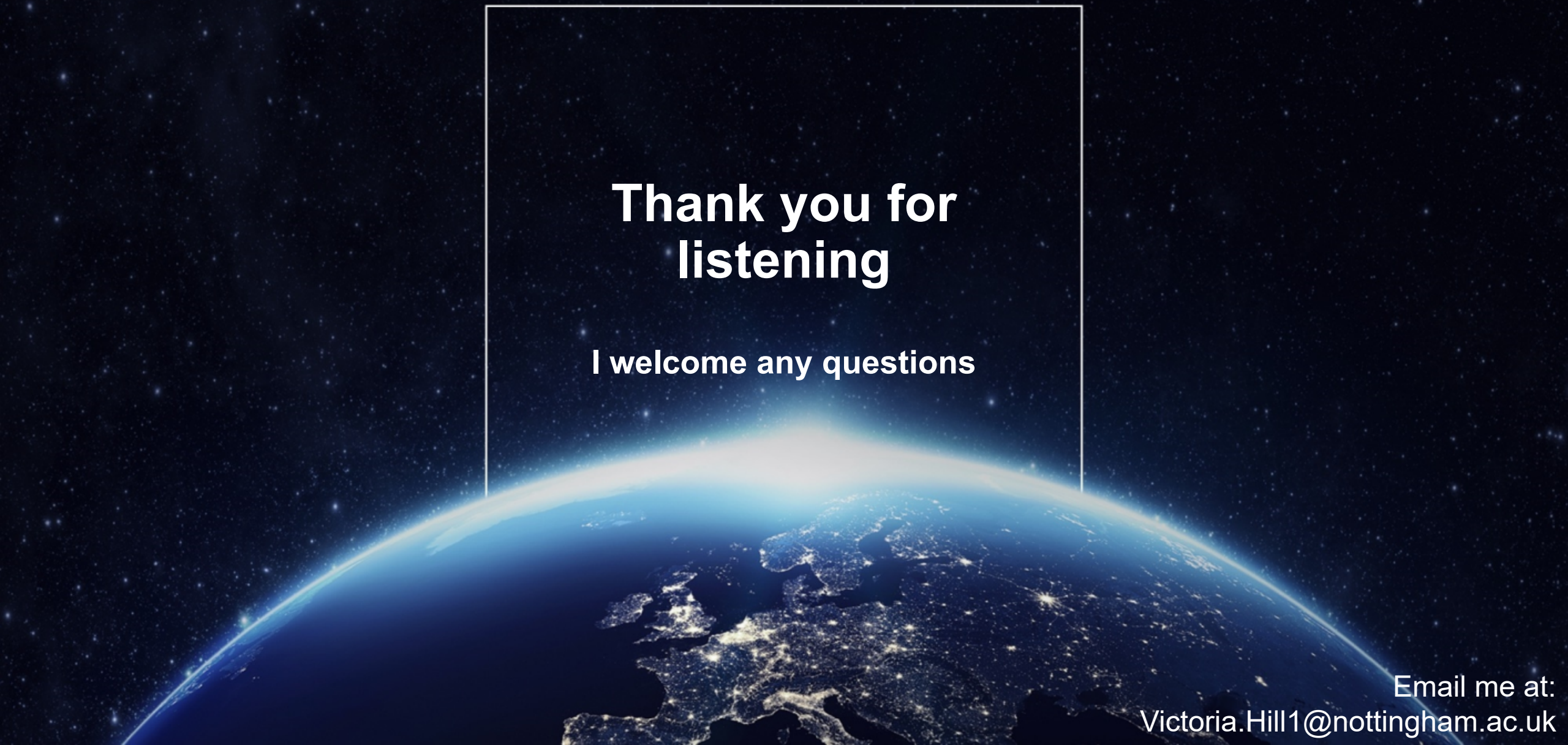
# Thank you for listening

I welcome any questions



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