Introduction

• Vitamin D is a crucial nutrient for calcium absorption and skeletal health in vertebrates.
• Vitamin D can be acquired from the diet or produced endogenously with UV exposure.

Methods

Main Investigation:
1. 2 hours irradiation at 45.1 MED/hr (Fig. 2)
2. Triplicate samples of five flies each recovered at time 0, immediately after irradiation, 6 hours after irradiation, 22 hours after irradiation, and a 24 hour non-irradiated control

UV Lamp Irradiation:

Sunlight Irradiation:
• 6 hr (8am to 3pm) irradiation (~2.5-3 MED/hr) on ice, samples of 50 flies taken and analyzed (Fig. 3)

Fruit Fly HPLC Analysis:
1. Files were extracted in 4 mL methanol, sonicated (Fig. 5), and centrifuged.
2. The supernatant was recovered, dried under nitrogen (Fig. 6), and reconstituted in 0.8% isopropl alcohol in hexane.
3. Extract was run through straight-phase high-performance liquid chromatography to quantify molecules of interest (Fig. 6, 7)

Amphole HPLC Analysis:
1. A sample of the contents of an ampoule were transferred to a culture tube, dried under nitrogen, and reconstituted in 0.8% isopropl alcohol in hexane.
2. Solution was run through straight-phase HPLC.

Results

• At time 0, pre-Vitamin D and tachysterol were observed, but no detectable vitamin D
• At time 6 and time 22, vitamin D detected, tachysterol and pre-D decreased in quantity

Fig. 9: Quantities of Pre-Vitamin D, Vitamin D, and Tachysterol Over Time

Fig. 10: Percent Conversion Pre-D to Vitamin D

Conclusions

• Drosophila melanogaster can and does produce pre-Vitamin D, vitamin D, lumisterol, and tachysterol after UV irradiation.
• Drosophila melanogaster does produce pre-Vitamin D and vitamin D when exposed to sunlight.
• The rate of conversion from pre-Vitamin D to vitamin D appears to be greater than that in the ampoule, at least initially.
• The quantity of vitamin D and pre-Vitamin D plateaus, instead of depleting and disappearing from the organism.

Discussion

The results indicate that, first and foremost, Drosophila does indeed possess the ability to convert cholesterol to vitamin D. They also appear to display some catalysis of the reaction. Previous studies have showed that iguana skin demonstrates membrane-mediated catalysis of the pre-D to vitamin D conversion (2) (Fig. 12). The effects of this catalysis in Drosophila is not as striking as the ones displayed in human or iguana skin, but this could be attributed to a key difference in the two studies. Whereas only skin samples of larger animals were analyzed in previous studies, this one kept the entire flies intact and alive. This introduces the possibility of metabolic activity in other regions of the organism, which could have far-reaching effects on the quantities of these molecules in each fly.

There are still many questions to be answered regarding vitamin D and insects. Many of these aspects, including the possible metabolism of vitamin D, partial catalytic activity, and relationship between vitamin D and ecophyse are all mysteries, and will require future studies to investigate. By pursuing answers to these questions, we can come closer to understanding the complex chemistry, pathways, and health effects of vitamin D, in insects and beyond.

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References