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Mechanisms that Regulate Skin Resistance to Water Loss Rates in Plethodon Salamanders Across Various Body Sizes

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Mechanisms of skin resistance to water loss rates in *Plethodon* salamanders across various body sizes

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Question: What are the mechanisms that control skin resistance to water loss of the lungless salamander *Plethodon metcalfi*?

Introduction: The ecology and evolution of organisms can sometimes be explained by mechanisms involving molecules, genes, and cellular characteristics. Lungless salamanders maintain moist skin in order to breathe, and consequently, salamanders lose water to their environment, limiting the amount of time they can forage and search for mates. Previous research indicated that salamanders can modify their skin resistance to water loss (R_s), which might have implications for their ecology. Here, we examine two mechanisms that may explain how salamanders modify skin resistance to water loss.

The Model Organism

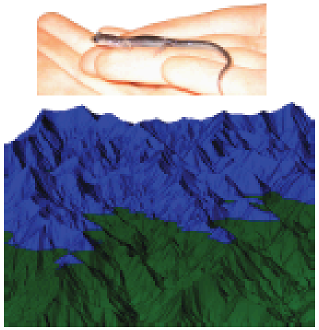


Figure 1. A 3D image of the field site with the elevational range of *P. metcalfi* in blue

Southern gray-cheeked salamander (*P. metcalfi*):

- nocturnal, lungless, and terrestrial
- wet skin to breathe
- activity limited by hydration state
- limiting water loss might increase fitness
- unknown mechanisms for controlling skin resistance to water loss

Background

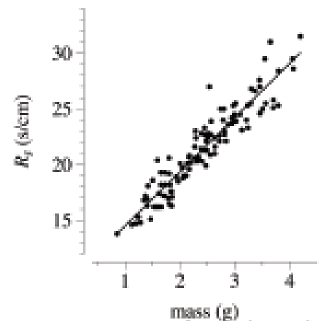


Figure 2. Larger salamanders exhibit higher skin resistance

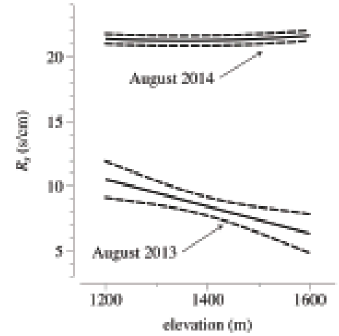


Figure 3. Annual variation of R_s along elevational gradient

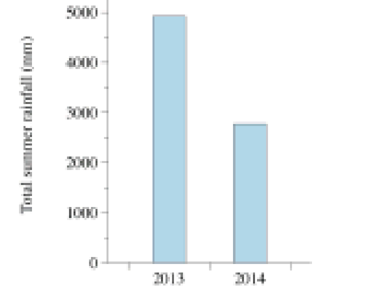


Figure 4. Higher total rainfall between years may explain annual variation of R_s

Potential Mechanisms

Passive: Mucous, Hydration, Morphology

Active: Lipid Content, Permeability, Hormones

Skin Morphology

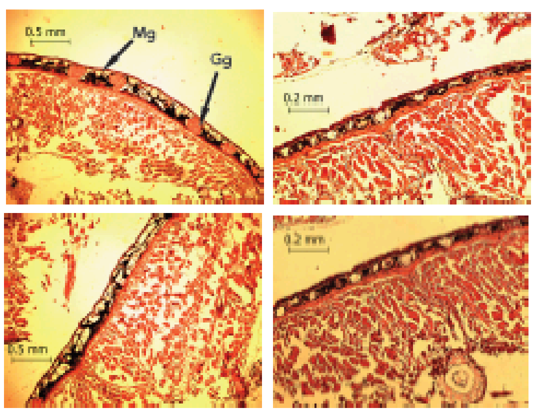
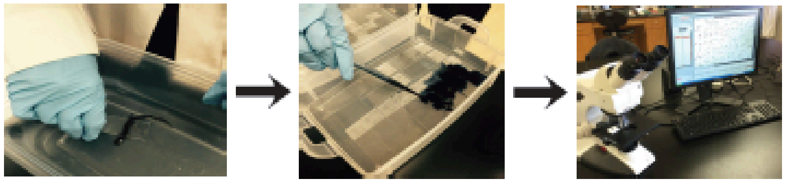


Figure 5. Cross sections of skin. Dermal pigment is black and granular (Gg) and mucous glands (Mg) are labelled.

RESULTS

- variation of skin thickness, gland density and structure, skin composition across body sizes

Lipid Secretions



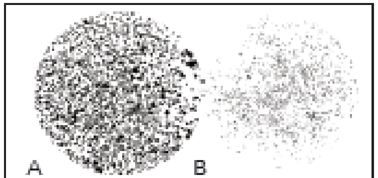


Figure 6. The (A) experimental and (B) negative control for staining lipids collected from skin secretions.

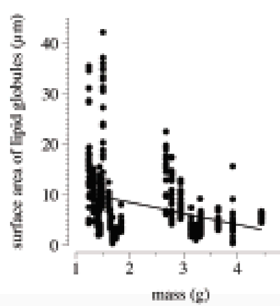


Figure 7. Within sample variation of skin secretion lipid content

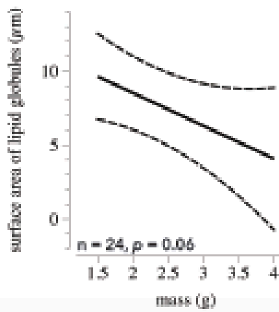


Figure 8. Inverse relationship between mass and lipid content

RESULTS

- within sample variation increased at smaller body sizes
- large individuals exhibit lower lipid content than small individuals

FUTURE STUDIES

- compensation of lipid content and skin secretions
- relationship between gland density and lipid content
- variation of lipid content in response to temperature and humdity