

PREDATORY DEFENSE

- ✘ Introduction
- ✘ Larva Defense
- ✘ Adult Defense
- ✘ Future Directions



LARVAL AND ADULT DEFENSES

- ✘ Predatory Pressures
- ✘ Many Defense Mechanisms
 - I. Behavioral
 - II. Physiological and Morphological
 - III. Chemical
 - IV. Phenological
 - V. Social



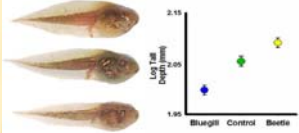

REDUCE PREDATOR DETECTION COLOR PATTERNS

- ✘ Camouflage
- ✘ Cryptic coloration
- ✘ Aposematic coloration



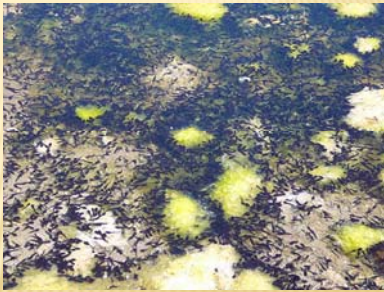
PHENOTYPIC PLASTICITY

- ✗ Color
- ✗ Tail depth/size
- ✗ Tail Morphology (Anurans)
- ✗ Caudates do too!
- ✗ Phenotypic Plasticity


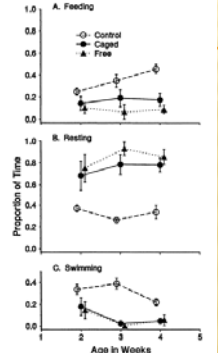



BEHAVIORAL

- ✗ Schooling
- ✗ Phenology Shifts
- ✗ Water Column Migration
- ✗ Stop Moving (Anurans and Caudates)



FORAGING ACTIVITY

A. Feeding

Age in Weeks	Control	Caged	Free
1	0.25	0.15	0.15
2	0.35	0.15	0.15
3	0.45	0.15	0.15
4	0.45	0.15	0.15

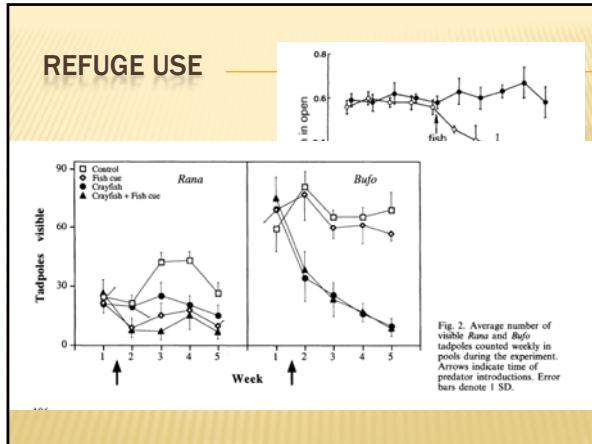
B. Resting

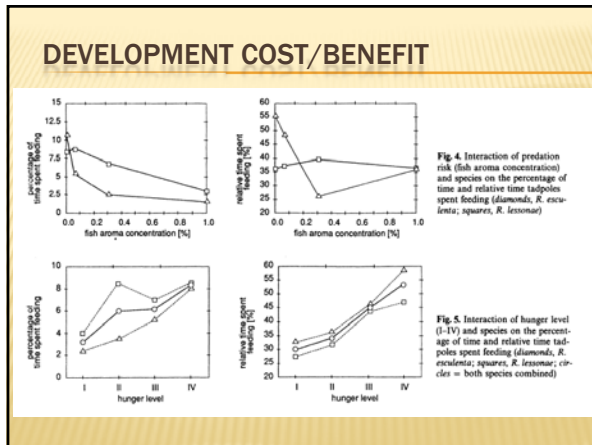
Age in Weeks	Control	Caged	Free
1	0.35	0.85	0.85
2	0.35	0.85	0.85
3	0.35	0.85	0.85
4	0.35	0.85	0.85

C. Swimming

Age in Weeks	Control	Caged	Free
1	0.15	0.15	0.15
2	0.15	0.15	0.15
3	0.15	0.15	0.15
4	0.15	0.15	0.15

FIG. 3. Behavior of *Rana chrysocoelis* in experimental ponds with caged dragonflies, free-ranging dragonflies, or no dragonflies since one week of age. The three panels show means \pm SE of the proportion of time tadpoles in releasing tanks spent feeding (A), resting (B), and swimming (C).





SENSORY CUES FOR DETECTION

- ✘ Tactile
- ✘ Visual
- ✘ Chemical
- ✘ MOSTLY chemical!!!
- ✘ No Predators Necessary!

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ALARM RESPONSES

- ✗ Injured Conspecific Chemical Cues
- ✗ Induced behavior
- ✗ Kin Selection?



GROWTH AND DEVELOPMENT

- ✗ Rapid Growth
- ✗ Larger=Less Vulnerable
- ✗ Faster Metamorphosis

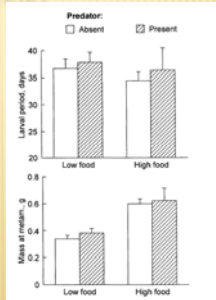


Fig. 7. Average larval period (upper panel) and body mass at metamorphosis (lower panel) in different predator treatments at constant volume. All the tadpoles metamorphosing from the constant volume treatments are included. Error bars refer to 95% confidence limits.

CHEMICAL DEFENSES

- ✗ Anurans distasteful or toxic
- ✗ Palatability to predators varies, research is inconclusive
- ✗ Can be stage dependent
- ✗ Why not evolve?



CRYPTIC COLORATION

- × Camouflage
- × Green, Yellow, Brown, Red, Gray
- × Color Change
- × Tree bark, Moss, Lichen, Leaves, Dermal flaps
- × Blotches



COLOR POLYMORPHISM

- × Tropical Anurans
- × Seasonal Changes
- × Selective Pressure=Predation
- × Apostatic Selection



ADULTS!

- × Cryptic Coloration
- × Aposematic Coloration
- × Cryptic Structure
- × Behavioral Avoidance
- × Behavioral Defense
- × Chemical Defense
- × Mimicry



BEHAVIORAL AVOIDANCE

- ✘ Chemical cues for Anurans and Caudates
- ✘ Terrestrial and Aquatic
- ✘ Predators and Injured conspecifics



BEHAVIORAL DEFENSE

- ✘ Flee!
- ✘ Play Dead
- ✘ Display Colors/Glands (Caudates)
- ✘ Vocalize to Scare
- ✘ Look Big
- ✘ Lose tail/Automize (Caudates)



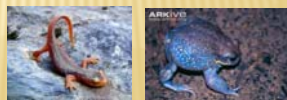
~~Lepidobatrachus laevis~~
Ambystoma laterale

CHEMICAL DEFENSE

- ✘ Granular Glands
- ✘ Toxic compounds is secondary
- ✘ Throughout body or locally concentrated
- ✘ Gland exposure through defensive posturing

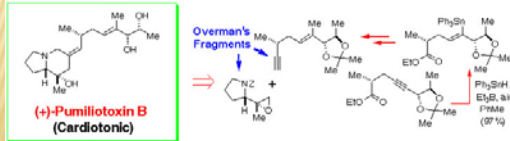


Common Fire Salamander
Salamandra salamandra



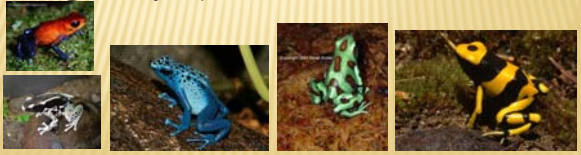
CHEMICAL TYPES

- ✗ Tetrodotoxins
- ✗ Cardiotoxic
- ✗ Steroidal Alkaloids
- ✗ Source is from diet...ants/ other insects
- ✗ Garter Snake Resistance in Pacific N.W.



APOSEMATIC COLORATION

- ✗ Honest Signal or Mimic
- ✗ Black, Red, Orange, Yellow
- ✗ Bright Blue, Bright Green
- ✗ Cryptic Dorsal Coloration/Aposematic Ventral
- ✗ Inguinal Eye Spots



MIMICRY

- ✗ Batesian Mimicry
- ✗ Avian Avoidance
- ✗ Caudates and Anurans
- ✗ Mullerian Mimicry



FUTURE RESEARCH

- ✦ Alarm Responses and Kin Selection
- ✦ Tadpole Palatability
- ✦ Adaptations to Invasive Predators