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Corticosteroid responses of snakes to toxins from toads (bufadienolides) and plants (cardenolides) reflect differences in dietary specializations

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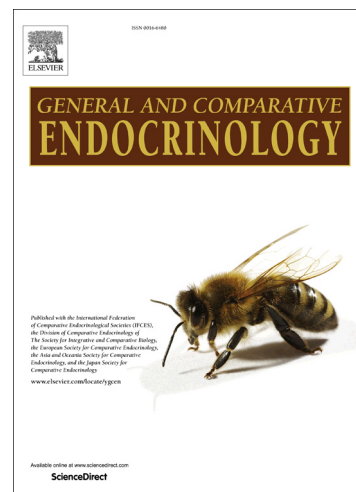
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1 **Corticosteroid responses of snakes to toxins from toads (bufadienolides)**  
2 **and plants (cardenolides) reflect differences in dietary specializations**

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14 HIGHLIGHTS

- 15 • Snake corticosteroid responses to toxins vary with dietary specialization and sex.  
16 • Snakes of the genus *Thamnophis* have high stress response to cardenolides.  
17 • Male *Rhabdophis tigrinus* have higher corticosteroid responses than females.

18 ABSTRACT

19 Toads are chemically defended by cardiotoxic steroids known as bufadienolides.  
20 Resistance to the acute effects of bufadienolides in snakes that prey on toads is conferred  
21 by target-site insensitivity of the toxin's target enzyme, the Na<sup>+</sup>/K<sup>+</sup>-ATPase. Previous  
22 studies have focused largely on the molecular mechanisms of resistance but have not  
23 investigated the physiological mechanisms or consequences of exposure to the toxins.  
24 Adrenal enlargement in snakes often is associated with specialization on a diet of toads.  
25 These endocrine glands are partly composed of interrenal tissue, which produces the  
26 corticosteroids corticosterone and aldosterone. Corticosterone is the main hormone  
27 released in response to stress in reptiles, and aldosterone plays an important role in  
28 maintaining ion balance through upregulation of Na<sup>+</sup>/K<sup>+</sup>-ATPase. We tested the  
29 endocrine response of select species of snakes to acute cardiotoxic steroid exposure by  
30 measuring circulating aldosterone and corticosterone concentrations. We found that

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