

## BIO 270 Animal Behavior

### Final Examination

This exam consists of 1 question worth 200 points.

Team question: Choose any topic related to animal behavior and compose an entry for Wikipedia.org on this topic. Be sure to thoroughly research the topic to ensure accuracy. In addition, consult and cite resources (minimum 8) from the **peer-reviewed primary literature** to support your entry. I expect this to be a **comprehensive and substantive** review of the topic, especially considering this is a team project with considerable time to complete the task. You may wish to include background, examples, related topics (you should suggest links within Wikipedia), and references and any other items which are commonly included in a Wikipedia entry. You should research the requirements for submissions to Wikipedia and take the steps necessary to give your submission the best chance of being accepted. You should submit to me your completed article and a copy of the Wikipedia entry on your topic as it appeared before you submitted your article to Wikipedia for publication and after your submission (though it may take some time for your entry to be available).

Topic: <https://en.wikipedia.org/wiki/Autohaemorrhaging>

#### **Background of Auto Hemorrhaging:**

Autohaemorrhaging, or reflexive bleeding, is a defensive mechanism many insects and some reptiles use to protect themselves from a predator. In reptiles, the blood may secrete out of the eyes or mouth. This behavior responds to a threat by voluntarily discharging blood (Resh 2009). Some insects, like crickets, have a toxin in their blood causing the predator to release its prey. It can cause the predator to be nauseous or it could poison that predator. It serves an antipredator function because it is used in the presence of a predator and it reduces the likelihood of predation (Middendorf and Sherbrooke 1992). This behavior has been noted since the early 1900s.

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## Animals that perform this behavior:

### 1. Insects:

- Insects use autohaemorrhaging as a defensive and sometimes chemical defensive mechanism (Bateman and Fleming 2009). Some insects will have toxins in their blood to make this a chemical defense. Many beetles secrete toxic hemolymph (Bateman and Fleming 2009), which is blood like fluid in insects. Ladybugs have the ability to reflexive bleed daily although the costs of this can affect their health (Knapp et al. 2020). Crickets are another species that use autohaemorrhaging as a defense mechanism against predators. One study examined different predation responses the Botswana Armoured Ground Cricket elicited and they also examined the different mechanisms between the male and female. They were interested in the distance, amount of hemolymph and if they could hemorrhage repeatedly (Bateman and Fleming 2009). This study found that autohaemorrhaging is an effective anti-predator defense in this species. They used bearded dragons as predators and they would drop the cricket after they released the hemolymph. When they examined differences between the sexes, they noted that males would first use stridulation, which is a noise defense. Then once the predators had either sex restrained they would bite. They found that females would regurgitate crops and auto haemorrhage more repeatedly than males. This could be due to the fact that they cannot perform stridulation (Bateman and Fleming 2009). They also found that where the crickets were attacked from affected if they autohaemorrhaged or not. If they were attacked from above they would use the blood squirting mechanism, but if they were attacked from the side they would bite first. It also affected how rapidly they would produce blood or how far they would squirt it (Bateman and Fleming 2009). There are many other insect species that use this defense tactic, but when they use it depends on how many other defense mechanisms they have.

### 2. Reptiles:

- Lizards:
  - [Horned lizards \(Phrynosomatidae\)](#) - horned lizards have the ability to shoot blood out of its eyes as a chemical defense mechanism against predators. It is mostly used when they feel threatened around canid predators such as foxes or wolves. Also, the discharge reduces predation (Sherbrooke and Middendorf 2004). This occurs from controlling the blood flow to the head. They are able to control the amount of blood that goes to the head and in return, they are about to shoot it from the eyes. It was also observed that blood can also come from the nasal cavity as well (Sherbrooke and Mason 2005). It was found that when the horned lizard used this defense mechanism against a [kit fox](#), they shook their heads back and forth while opening and closing their jaw while having excessive tongue licking (Sherbrooke and Middendorf 2004, Sherbrooke and Mason 2005). It also seems like chemicals in the blood of the lizard make the predators react in a negative way. It is not toxic to them, but it does confuse them, as the predators shake their head in a disgusted way (Sherbrooke and Middendorf 2004). This also happens if mice are covered in the horned lizards blood, indicating that the blood makes the predators react in a negative way. This defense mechanism does not seem like it is very effective. According to the article that was published by Wade C. Sherbrooke and George A. Middendorf, six studies were done in the experiment. Most of the lizards have died while they were being conducted, but the ones that survived did successfully survive against the kit foxes. [Coyotes](#) also express this behavior as well, as they react in a negative way like the kit foxes do (Sherbrooke and Mason 2005). Against predators, they react in a disgusted way, making them not eat the lizard if blood is shot from their eyes (Sherbrooke and Middendorf 2004, Sherbrooke and Mason 2005). According to both studies, it takes a long time for the predators to eat the horned lizard and it makes them sick as well if they eat parts of the lizard or mice covered in the blood.
- Snakes:
  - West Indian Wood Snake (Tropidophis):
    - West Indian Wood Snakes are the common name of the [Tropidophis](#) genus that can auto haemorrhage in response to predation. They will ooze blood out of their mouth, nostrils, and their eyes will fill up with blood. They do not have the ability to squirt their blood, as seen with the horned lizard. The blood not only smells foul, but gives off the impression that the snake is dead and decomposing. This will make the snake less appealing for the predator to eat. In a study on the leopard dwarf boa ([Tropidophis pardalis](#)), the method this occurs by was found. Upon rough or stressful situations, the blood will begin to pour from the roof of the mouth. Before it begins to pour, the area between the [spectacle](#) and eye will fill with blood briefly. Then two longitudinal blood vessels in the roof of the mouth enlarge and blood begins to seep out and coat everything around it. The blood also does not clot like normal blood, remaining a liquid long after it is released. The blood does not seem toxic to prey based on studies, as it only causes minor [hemolysis](#). This supports the idea that the bleeding is only used to ward off predators by making

themselves look less appetizing, rather than using it to hurt their predators (Hecht et al., 1955).

- European Grass Snake (*Natrix natrix*):
  - The European Grass Snake uses autohaemorrhaging in order to [feign death](#) in order to avoid predators. Upon a predator's approach, the snake will initially attempt to hide. If unsuccessful, the snake will make a spectacle of its death. It will roll into a ball, writhing in agony. After doing this, the snake will allow its head to fall to the side, opening its mouth and exposing its tongue. In the process, the snake has been seen to self-wound in order to bleed and make the death appear more realistic, sending signals to predators that the snake is diseased.
- Long-nosed Snake (*Rhinocheilus lecontei*):
  - This snake will secrete blood from the cloaca. This behavior is done when they are harassed by other predators. Fecal matter is also released from the cloaca as well. This is a defense mechanism that is done so the predators will not attack or harm the snake any more.
- Eastern Hognose Snake (*Heterodon platirhinos*):
  - This snake will also secrete blood from the cloaca region as well. It is not a common thing for these snakes to do but they do this when playing dead, as a foul scent and fecal matter come out as well.
- Plain-bellied water Snake (*Nerodia erythrogaster*):
  - Like the other snakes, the plain-bellied water snake will use reflexive bleeding in response to predation. This snake will ooze blood out of its mouth.

#### **Benefits of autohaemorrhaging:**

- Helps them fight off against big predators, especially candid predators
- Makes the predators confused or react in a negative way
- Makes prey unappetizing to predators

#### **Consequences (costs) of autohaemorrhaging:**

- Does not seem too effective for the horned lizard, in the studies used, most of them were killed by the kit foxes and coyotes
- They are losing blood, sometimes a decent amount. This can lead to complications such as dehydration, loss of body weight, and cannibalism.
- As seen with a study done on ladybugs, daily reflexive bleeding caused them to have a weakened immune system (Knapp et al. 2020).

#### **Extra Links for examples of auto hemorrhaging:**

Horned lizard articles

- [https://www.jstor.org/stable/1448486?seq=1#metadata\\_info\\_tab\\_contents](https://www.jstor.org/stable/1448486?seq=1#metadata_info_tab_contents) (1)
- [https://www.jstor.org/stable/3672860?seq=1#metadata\\_info\\_tab\\_contents](https://www.jstor.org/stable/3672860?seq=1#metadata_info_tab_contents) (2)

Insect article

- <https://doi.org/10.1126/science.134.3475.329>



- <https://ezproxy.stevenson.edu:2088/eds/pdfviewer/pdfviewer?vid=30&sid=af004c07-187e-4536-8847-d72f4d83e594%40sdc-v-sessmgr02>

Wood snake

- <https://asknature.org/strategy/defense-mechanism-deters-predators/>

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Bateman PW, Fleming PA. 2009. There will be blood: autohaemorrhage behaviour as part of the defence repertoire of an insect. *Journal of Zoology*. 278(4):342–348.

Happ, G. M., & Eisner, T. (1961). Hemorrhage in a Coccinellid Beetle and Its Repellent Effect on Ants. *Science*, 134(3475), 329–331

Hecht, M. K., Walters, V., & Ramm, G. (1955). Observations on the Natural History of the Bahaman Pigmy Boa, *Tropidophis pardalis*, with Notes on Autohemorrhage. *Copeia*, 1955(3), 249–251. <https://doi.org/10.2307/1440479>

Knapp M, Řeřicha M, Židlická D. 2020. Physiological costs of chemical defence: repeated reflex bleeding weakens the immune system and postpones reproduction in a ladybird beetle. *Sci Rep*. 10. doi:10.1038/s41598-020-66157-9. [accessed 2021 May 11]. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7283328/>.

Middendorf GA, Sherbrooke WC. 1992. Canid Elicitation of Blood-Squirting in a Horned Lizard (*Phrynosoma cornutum*). *Copeia*. 1992(2):519–527. doi:10.2307/1446212.

Resh VH. 2009. Chapter 16 - Autohemorrhage. In: Resh VH, Cardé RT, editors. *Encyclopedia of Insects (Second Edition)*. San Diego: Academic Press. p. 64. [accessed 2021 May 10]. <https://www.sciencedirect.com/science/article/pii/B9780123741448000163>.

Sherbrooke WC, Mason JR. 2005. Sensory Modality Used by Coyotes in Responding to Antipredator Compounds in the Blood of Texas Horned Lizards. *The Southwestern Naturalist*. 50(2):216–222

Sherbrooke WC, Middendorf GA. 2004. Responses of Kit Foxes (*Vulpes macrotis*) to Antipredator Blood-Squirting and Blood of Texas Horned Lizards (*Phrynosoma cornutum*). *Copeia*. 2004(3):652–658.

Ushakov, M. V. (2007). On the defensive behavior of the grass snake *Natrix natrix* (Linnaeus, 1758). *Russian Journal of Ecology*, 38(2), 124–127. <https://doi.org/10.1134/s1067413607020105>

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## Autohaemorrhaging

From Wikipedia, the free encyclopedia

**Autohaemorrhaging**, or **reflex bleeding**, is the action of animals deliberately ejecting blood from their bodies. Autohaemorrhaging has been observed as occurring in two variations.<sup>[1]</sup> In the first form, blood is squirted toward a predator. The blood of these animals usually contains toxic compounds, making the behaviour an effective chemical defence mechanism. In the second form, blood is not squirted, but is slowly emitted from the animal's body. This form appears to serve a deterrent effect, and is used by animals whose blood does not seem to be toxic.<sup>[1]</sup> Most animals that autohaemorrhage are insects, but some reptiles also display this behaviour.<sup>[2]</sup>

Some organisms have shown an ability to tailor their autohaemorrhaging response. Armoured crickets will projectile autohaemorrhage over longer distances when attacked from the side, compared to being attacked from an overhead predator.<sup>[3]</sup>

Horned lizard exhibiting autohaemorrhaging.

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**Insects** [edit]

Five orders of insects have been observed to utilize this defence mechanism.

- Beetles
  - Meloidae (bister beetles) – their haemolymph contains *cantharidin* that they sequester from plants on which they feed.
  - Timarctidae species
  - Chrysomelidae – their haemolymph contains *anthraquinones*.
  - Coccinellidae (ladybird, ladybug or lady beetles) – An alkaloid toxin is exuded through the joints of the exoskeleton, triggered by mechanical stimulation (such as predator attack).<sup>[4]</sup>

Languages

- Deutsch
- Español
- Français
- Slovenščina
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- Tiếng Việt
- 粵語
- Edit links

- Hemiptera
  - Cercopidae – including spittlebugs *Prosapia bicincta* and *Prosapia lignipuncta*<sup>[5]</sup>
- Hymenoptera
  - Sawfly larvae
- Orthoptera
  - Bushhoppers, such as *Dictyophorus spumans*, *Phymateus viridipes* and *Phymateus leprosus* – their haemolymph contains cardiac glycosides, sequestered from milkweed on which they feed.
  - Katydid, including *Eugaster* species
  - Armoured ground crickets
  - Eryalopsis nyata*
- Plecoptera
  - Stonely larvæ

**Reptiles** [edit]

**Lizards** [edit]

- Horned lizards (Phrynosomatidae). At least six species of horned lizards are able to squirt an aimed stream of blood from the corners of their eyes, up to 5 feet (1.5 m).<sup>[6]</sup>

A West Indian wood snake exhibiting autohaemorrhaging. The eyes are fully flooded with blood and some drops expelled through the mouth.

**Snakes** [edit]

- West Indian wood snake (*Tropidophis*). Thirteen species have been found to expel blood from the mouth and nostrils while also fully flooding both eyes with blood.<sup>[7]</sup>
- European grass snake (*Natrix natrix*), which secretes blood from the lining of the mouth while playing dead.<sup>[8]</sup>
- Long-nosed snake (*Rhinocellus lecontei*), which exudes blood from the cloaca.<sup>[9]</sup>
- Eastern hognose snake (*Heterodon platyrhinos*), which emits blood from the cloacal region.<sup>[9]</sup>
- Plain-bellied water snake (*Nerodia erythrogaster*), which releases blood from the mouth.<sup>[9]</sup>

**Consequences of reflexive bleeding** [edit]

In some cases, the loss of blood can be substantial. Beetles may lose up to 13% of their net body weight as a consequence of expelling haemolymph.<sup>[10]</sup> Autohaemorrhaging may result in dehydration. The ejection of blood puts organisms at risk of cannibalism from conspecifics.<sup>[11]</sup>

**See also** [edit]

- Autothysis

**See also** [edit]

- Autothysis
- Haemorrhage

**References** [edit]

- ↑ Itze, Alexander; Itze, Oana (January 2014). "Thanatosis and autohaemorrhaging in the Assoulian Snake *Zamenis*". *Herpetozoa* **26** (3–4): 173–174 – via Zobodat.
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- ↑ Baleman, Philip W.; Fleming, Patricia A. (2012-04-26). "Signaling or Not-Signaling: Variation in Vulnerability and Defense Tactics of Armored Ground Crickets (Acanthopplus Speiseri: Orthoptera, Tettigonidae, Heterodinae)". *Journal of Insect Behavior* **26** (1): 14–22. doi:10.1007/s10805-012-9329-5. ISSN 0892-7553.
- ↑ The Alkaloids: chemistry and physiology, Volume 31 By Arnold Bross
- ↑ Thompson, Vinton; Carvalho, Genasio S. (2016). "Abrupt Geographical Transition between Aposematic Color Forms in the Spittlebug *Prosapia lignipuncta* (Hemiptera: Cercopidae)". *Psyche: A Journal of Entomology* **2016**: 1–10. doi:10.1155/2016/2020202.
- ↑ Sherrinckes, Wade C.; Midsendorf III, George A. (2001). "Blood-Squirting Variability in Horned Lizards (Phrynosoma)". *Copeia* **2001** (4): 1114–1122. doi:10.1643/0045-8511(2001)001[1114:BSVH]2.0.CO;2. ISSN 0045-8511.
- ↑ Hoefer, Sebastian; Mills, Sophie; Robinson, Nathan J. (2019). "Autohaemorrhaging in a Bahamian pygmy toad, *Tropidophis curtus barbouri*". *The Herpetological Bulletin* (150). doi:10.33256/hb150.3940.
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An inactive orange-bellied lady beetle autohaemorrhaging, resulting from cannibalism by an adult of the same species.

**External links** [edit]

- Media related to Autohaemorrhaging at Wikimedia Commons

Categories: Antipredator adaptations | Blood | Insect physiology

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