



### Location

Outdoors and in the classroom

### Supplies

Digital camera (phone or handheld), Internet Access, Journal or Sketchbook and Sketching Supplies, Data sheets, Pencil, Watches or timers, Clipboard (optional)

### Standards

NGSS: K-ESS2-1, K-LS1-1, 2-LS4 -1, 3-LS3-1, 3-LS3-2, 3-LS4-2, 4-LS1-1, 5-PS3-1, 5-LS2-1, MS-LS2-2, HS-LS2-2, HS-LS2-6  
CCSS  
ELA: 6-12.W.1, 9-12.W.9  
CCSS Math: K.OA.1, 1.MD.4, 2.MD.10, 3.MD.3, 4.MD.4, 5.MD.2, 6.SP.4, 6.SP.5, 8.SP.1, Algebra I S-ID.6, Algebra II S-IC.4, Vocabulary

## SLIME Survey

### Grades K-12

### Overview

Malacology is the study of mollusks, which are invertebrates like the snails and slugs you see in your local flower beds and on the sidewalk after it rains. The SLIME project is a community science project where you and scientists at the Natural History Museum of L.A. County work together to better understand snails and slugs through research!

Did you know some species of snails are only known by their shells? Snails and slugs are important indicators of how a habitat is doing, but we know very little about them compared to other wildlife. Malacology is a field full of understudied mysteries, and you can help malacologists (scientists who study mollusks) shed some light on snails and slugs.

### Concepts

- Consistent observations can be compiled into workable data sets.
- Data can be evidence from which students can support a claim.

### Objectives

- Students will practice making and recording observations outdoors.
- Students will improve their data-collection skills through practice and reflection.
- Students will analyze their own and open-source collected data and produce graphs or other visual representations of their observations.

## Outline

- Students will practice recording observations in an outdoor setting for the first few sessions.
- For the next session, students will make more structured observations using a timed drawing exercise.
- For the last few outdoor sessions, students will collect data directly into the iNaturalist app.
- The class will analyze and pictorially represent its data at grade appropriate levels.

## Resources and References

- **"Opening the World Through Nature Journaling"** - California Native Plant Society  
[cnps.org/education/documenting-natural-phenomena-6069](https://cnps.org/education/documenting-natural-phenomena-6069)
- **Using the Outdoor Classroom**  
[nhm.org/sites/default/files/2019-04/using\\_the\\_outdoor\\_classroom\\_handout.pdf](https://nhm.org/sites/default/files/2019-04/using_the_outdoor_classroom_handout.pdf)
- **Adding an Observation on the iNaturalist App**  
[vimeo.com/162581545](https://vimeo.com/162581545)
- **Adding an Observation on the iNaturalist.org Website and Adding/Editing Bulk Observations**  
[vimeo.com/167431843](https://vimeo.com/167431843)
- **Exploring Observations on iNaturalist**  
[vimeo.com/331279497](https://vimeo.com/331279497)
- **SLIME: Slugs and snails Living In Metropolitan Environments Project at NHM.org**  
[nhm.org/community-science-nhm/slime](https://nhm.org/community-science-nhm/slime)
- **Field Journal - Bilingual English/Spanish**  
[nhm.org/sites/default/files/2024-02/Field\\_Journal\\_Bilingual\\_English\\_Spanish.pdf](https://nhm.org/sites/default/files/2024-02/Field_Journal_Bilingual_English_Spanish.pdf)

# SLIME Community Science in the Classroom

Remind students to avoid handling wildlife as much as possible. If they do handle a snail or slug, make sure they can wash or sanitize their hands afterwards.

## The 4 Steps of Making an Observation

Learning research shows that students engage in four steps while making scientific observations. This lesson plan takes students through each step, building essential skills to contribute to scientific data and research.

1. **Exploring** the outdoors and natural habitat.
2. **Observing** individual organisms.
3. **Identifying** the organism.
4. **Recording** information about the organism.

“We found that observing species was the most prevalent activity that youth took part in at BioBlitzes, with exploring and searching for organisms more commonly observed in younger ages. Relatively few youth were observed making and sharing biological records.”

- *Enhancing youth learning through Community and Citizen Science: a guide for practitioners*  
[education.ucdavis.edu/post/resources-practitioners-publications](http://education.ucdavis.edu/post/resources-practitioners-publications)

As educators you are encouraged to support students through to the recording step of making observations. Some ways to support students:

- Emphasize existing research based on their contributions (see FAQ).
- Reminders that 0 (no observations) is still important data to document.
- Logistic technical support in uploading to iNaturalist.
- Emphasize that recorded data will be used in Week 5 for analysis.



# Lesson Plan

## Week 1: Exploring and Observing

### Two 20-Minute Sessions

In the first week, students will get comfortable looking for slugs and snails in the outdoor classroom. While in the classroom, establish the ground rules for the outdoor classroom. Snails and slugs are typically found under deep leaf litter, logs, planters and flower pots, etc. They are most active at night, but can be found out and about after rain, watering the yard, and in the cooler early-morning hours. Print or draw a map of your outdoor classroom and have students mark the locations of snails and slugs, including a brief description of where they were found and weather conditions. As you begin to explore your outdoor classroom, ask students:

- Where might we find snails and slugs? What might their microhabitat look like?
- What time do you think snails and slugs would be most active and easy to find?
- What weather do you think snails and slugs would be most active in?

### Using the Outdoor Classroom

[nhm.org/sites/default/files/2019-04/using\\_the\\_outdoor\\_classroom\\_handout.pdf](https://nhm.org/sites/default/files/2019-04/using_the_outdoor_classroom_handout.pdf)

### Field Journal - Bilingual English/Spanish

[nhm.org/sites/default/files/2024-02/Field\\_Journal\\_Bilingual\\_English\\_Spanish.pdf](https://nhm.org/sites/default/files/2024-02/Field_Journal_Bilingual_English_Spanish.pdf)

## Week 2: Observing and Identifying

### One 30-minute session

In this second week, students will practice making observations in an outdoor environment simply by journaling. Lead students to your chosen outdoor location with journals and pencils, and explain that they will be sketching and taking notes about any snails and/or slugs they see. Remind them that observational drawings don't need to be pretty or perfect, they just need to reflect what the student sees. Give students about 10-15 minutes of sketching time; then reconvene and ask what students noticed about snails and slugs.

- What parts of the snail/slug did they notice?
- What size and color was the snail/slug?
- Where was the snail/slug living?

"Opening the World Through Nature Journaling" - California Native Plant Society  
[cnps.org/education/documenting-natural-phenomena-6069](https://cnps.org/education/documenting-natural-phenomena-6069)

## Week 3 - Week 4: Recording

### Four 30-minute sessions

Week three asks students to begin seriously recording data on iNaturalist by uploading observations. Alternatively, students can use the worksheets provided. Please note that recording on worksheets will not contribute to the SLIME community science project.

Before heading outdoors, take a moment to review the previous week's work with the students and remind them of all the information they've learned about finding and observing snails and slugs.

From Week 1 students practiced **Exploring** and **Observing** by mapping out the locations of snails and slugs. iNaturalist observations should include location, time and date information to be a part of the research database.

From Week 2 students practiced **Observing** and **Identifying** by taking a close look at the different morphological features of snails and slugs. Some of these features are diagnostic for species identification. Students should aim for a "snail or slug photoshoot" with their observations, capturing different angles and morphological features.



Recording data on iNaturalist incorporates your students' data into one of our researchers' ongoing Community Science Projects! It is probably easiest to upload the data with a class account managed by the instructor. Head outside and start collecting data!

**Remember to tag your observations on iNaturalist with #SLIMESchools so researchers can see students showing up for science!** You can add the #SLIMESchools tag to all of your student's observations at once on the iNaturalist website.

[Adding an Observation on the iNaturalist App](https://vimeo.com/162581545)  
vimeo.com/162581545

[Adding an Observation on the iNaturalist.org Website and Adding/Editing Bulk Observations](https://vimeo.com/167431843)  
vimeo.com/167431843

## **ELEMENTARY SCHOOL**

Explain to students that they'll be documenting the number of snails and slugs they see. You can split groups into one team to find snails and another team to find slugs.

At the end of the survey period review the existing data on iNaturalist in your area for snails and slugs to show student contributions to research data.

## **MIDDLE AND HIGH SCHOOL**

Explain to students that they'll be documenting the snails and slugs they see. Upon finding a snail or slug, students should spend 1-3 minutes observing that individual and identifying any different species the snail or slug interacted or was found with, such as plants used for food or habitat or other species found sheltering with the snail or slug. Students should record species interactions, weather and temperature conditions on their iNaturalist observations under the notes section. NOTE: 11-12th grade, split students into two groups and have them observe different populations or environments, make observations at different times of day, or other independent variables that the class has noticed over the past few weeks.

At the end of the survey period review the existing data on iNaturalist in your area for snails and slugs to show student contributions to research data.

[Exploring Observations on iNaturalist](https://vimeo.com/331279497)  
[vimeo.com/331279497](https://vimeo.com/331279497)

## **Week 5: Data Analysis**

In week 5 students will explore the observations they've collected as data, creating graphs and charts that answer questions about the terrestrial gastropods they've observed over the last four weeks.

### **K-1st grade**

Ask students to get into groups of 2-5 and review the data they've collected. For example, students can count how many snails vs how many slugs the class found from the class iNaturalist observations or their worksheets.

### **2nd-3rd grade**

Ask students to create a bar graph of the types of species interactions they saw on one day. Based on the graphs they create, ask students to solve word problems like the examples below.

- Which species did snails interact with most?
- Which species did slugs interact with most?

### **4th-5th Grade**

Ask students to create a line plot graphing the proportions of snails and slugs the students saw throughout weeks 3-4. Based on the graphs they create, ask students to solve word problems like the examples below. You will need to cater the problems to the graphs the students produced.

- On day one of data collection, how many snails and slugs out of [total number] did we see?
- How many snails and slugs did we see on day four?
- Is there a difference between how many snails vs how many slugs we've found?

## MIDDLE SCHOOL

Ask students to create a few graphs depicting the number of snails and slugs they saw active in the environment (dependent variable) versus the temperature or weather conditions (independent variable). For example, they might graph the number of different-species interactions on sunny and cloudy days, or the number of active snails and slugs at different temperature ranges. Then, ask students to look for correlations between the variables:

Is there any pattern to snail and slug behavior in certain weather conditions or temperatures?

Whether yes or no, ask students to think about why that might be, and write up a short paragraph or two describing their answer and evidence.

## HIGH SCHOOL

Ask students to create a scatter plot showing two quantitative variables of their choice—for example, number of snails and slugs seen versus the temperature on that day, or how many slugs and snails were found versus time of day. Then, ask students to present their graphs, and describe their findings and the relationship between their chosen variables (including no relationship).

EXTENSION: Ask students to research the introduction of the Spanish Snail/Milk Snail (*Otala lactea*) to California. What kind of impact did that animal's introduction have on native species?

Using data from iNaturalist, ask students to create a second scatter plot showing the number of Spanish Snails/Milk Snails versus the number of Native Snail species in the Los Angeles area. (they can use a section of their choice). Have them write a 1-2 page description of their graph that answers the following question: Based on their research, what explanation might they offer for the graph?

[Exploring Observations on iNaturalist](#)

[vimeo.com/331279497](https://vimeo.com/331279497)

[How to Search for Native Species on the iNaturalist Website: Under Taxon Status](#)

[inaturalist.org/pages/search+urls](https://inaturalist.org/pages/search+urls)

## Conclusion

Students have now completed their own field surveying, data collection and data analysis! Reflect on the process with students by recognizing their contributions to science and explore their curiosity with questions like:

- What further research would you like to follow up on?
- What did you think about snails and slugs before these lessons? What do you think about them now?
- What questions do you still have? Do you think you can answer them using the same process of field surveying, data collection and data analysis?
  - If not, where do you think you'll find the answer?

## SLIME FAQ

### Why is it important to study terrestrial gastropods (land snails and slugs)?

- Since snails and slugs can't travel far, their presence helps scientists understand the health of their local habitat. If an area has a native snail species present, that tells us that this habitat has been preserved and supports vulnerable species. On the other hand, introduced and invasive species in an area can damage habitats and native species, and it is helpful to know where they're found and how they're being moved from place to place.

### How has community science helped us understand terrestrial gastropods?

- iNaturalist observations in Brazil, for example, have contributed photos of live snails previously only known by their shells, potentially new species, and records of species that were previously thought to be extinct. For more information read "[iNaturalist as a tool in the study of tropical molluscs](https://doi.org/10.1371/journal.pone.0268048)" ([journals.plos.org/plosone/article?id=10.1371/journal.pone.0268048](https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0268048)). In L.A. County, NHMLAC's own malacologist Dr. Jann Vendetti shares her research on introduced species using iNaturalist data - see the science on the [SnailBlitz website](https://nhm.org/snailblitz-2024) ([nhm.org/snailblitz-2024](https://nhm.org/snailblitz-2024)).

### How are terrestrial gastropods studied at NHMLA?

- Your photos that show details of slugs and snails help malacologists identify the different species that live in Southern California and where they are when you share them with the SLIME project. The Natural History Museum of L.A. County is home to a large collection of snails and slug specimens, which are used to understand species morphology (traits of the body) with tools like the [Scanning Electron Microscope \(SEM\)](https://nhm.org/learning-resource/get-scoop-scope) ([nhm.org/learning-resource/get-scoop-scope](https://nhm.org/learning-resource/get-scoop-scope)).

### What is the SLIME Project?

- Snails and slugs Living in Metropolitan Environments (SLIME) ([nhm.org/community-science-nhm/slime](https://nhm.org/community-science-nhm/slime)) is a community science project that aims to catalogue the biodiversity of terrestrial gastropods (land snails and slugs) in Southern California. The Natural History Museum's collection of land snails includes thousands of specimens from locations throughout the Southern California region and spans the last 100 years. However, not much is known about this mollusk biodiversity today, especially within the cities of Southern California. That's where community scientists come in! SLIME is the first community science snail survey focusing on urban Southern California, and adjacent wild lands. With this information we hope to identify the species that call Los Angeles home, those that are new to the area, and those that haven't been able to survive the changes that urbanization has made to their homeland.

### What is SnailBlitz?

- SnailBlitz ([nhm.org/snailblitz-2024](https://nhm.org/snailblitz-2024)) is a yearly effort to collect as many photos of terrestrial gastropods as possible during Southern California's rainy season to the Natural History Museum of Los Angeles County's SLIME project. Join us each year for virtual and in-person events and prizes!

## Vocabulary

- **Mollusks:** Invertebrate(s) which includes snails, slugs, mussels, and octopuses. They have a soft unsegmented body and live in aquatic or damp habitats, and most kinds have an external shell.
- **Malacology:** the study of mollusks, a Malacologist is a scientist who studies molluscs.
- **Morphology:** the study of traits of the body.
- **Invertebrates:** an animal lacking a backbone.
- **Terrestrial:** an animal that lives on land.
- **Gastropods:** comes from Greek that means “stomach foot”. A type of mollusk that typically has a flattened muscular foot and a head with stalked eyes. Includes snails, whelks, limpets, and slugs.
- **Habitat:** the natural home or environment of an animal, plant, or other organism.
- **Microhabitat:** a small, localized habitat within a larger ecosystem that might have unique qualities for specific species (example: under a log).
- **Endemic:** a species that is native to an area and restricted to that area.
- **Native:** a species that originated and evolved in their surrounding habitat and has adapted to living in that particular environment.
- **Introduced:** a species transported out of their native habitat range by people, either purposefully or accidentally, such as in shipping containers or releasing aquarium fish into a pond.
- **Invasive:** An introduced, non-native species that spreads their range from where they were introduced and has the potential to cause harm to the environment.
- **Community Science:** sometimes called “citizen science”, Projects in which volunteers partner with scientists to answer real-world questions. - *Cornell Laboratory of Ornithology*
- **Diagnostic (Species ID):** characteristics of a species that differentiate that species from others similar to them, such as the shape of a snail shell.
- **Data:** facts or statistics gathered for reference or analysis. In this case, students’ iNaturalist observations or worksheets are data.
- **Open-Source Data:** data that anyone can access, use and share, such as the research-grade observations found on iNaturalist.

## Explore More: Additional fun activities and resources

- [Create an iNaturalist Project for Your Classroom! Why an iNaturalist Project?](https://nhm.org/sites/default/files/2019-04/how_to_join_or_create_inaturalist.org_projects.pdf)  
nhm.org/sites/default/files/2019-04/how\_to\_join\_or\_create\_inaturalist.org\_projects.pdf
- [Follow @NatureInLA for SnailBlitz and SLIME Updates, Prizes and Virtual Events](https://www.instagram.com/natureinla)  
instagram.com/natureinla
- [Meet Dr. SLIME: Featuring Dr. Jann Vendetti, NHMLA Malacologist and Research Scientist of the SLIME Project!](https://nhm.org/stories/meet-dr-slime)  
nhm.org/stories/meet-dr-slime
- [SnailBlitz x The Snail Hospital](https://www.instagram.com/the_snail_hospital): Check out the adorable and informational Instagram content by Chelsea Alexander, snail rehabber!  
instagram.com/the\_snail\_hospital

*Snails in the Classroom Image Credit: Chelsea Alexander / @The\_Snail\_Hospital on Instagram*

*Snail and Slug Illustration Credit: @TheSlimeScholar on Instagram*

**See the following pages for worksheets and coloring sheets**

# SLIME Survey: Outdoor Map

Name:

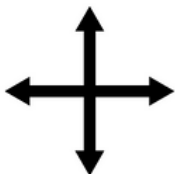
Date:

Time:

Temperature:

Weather:

Draw a map of the area. Include details like trees, flower beds, planters/flower pots, bushes, paved and unpaved areas, and anything else you observe about the environment.



Where is North, East, South and West?

# SLIME Survey: Observations

Name:

Temperature:

Date:

Weather:

Time Started:

Time Stopped:

**How many slugs and snails can you find? Mark a tally under the slug or snail for each one you see.**



**Snails**



**Slugs**



# SLIME Survey: Observations

1/2

Name:

Date:

Time Started:

Time Stopped:

Temperature:

Weather:

To document species interaction: Mark whether the animal you're observing is a snail or slug in the first two columns. In the next column write down what species you're observing the snail or slug interact with. If you don't know the species, write down what you DO know - is the plant a tree, bush or flower? Did you find the snail or slug under a rock with pill bugs, millipedes or other insects? Add a mark in the fourth column for each time you see a snail/slug and that species interact. If you observe a snail and slug together, mark both in the first two columns. If you observe a snail, slug, and another species together, mark the first two columns and document the other species in the third column.





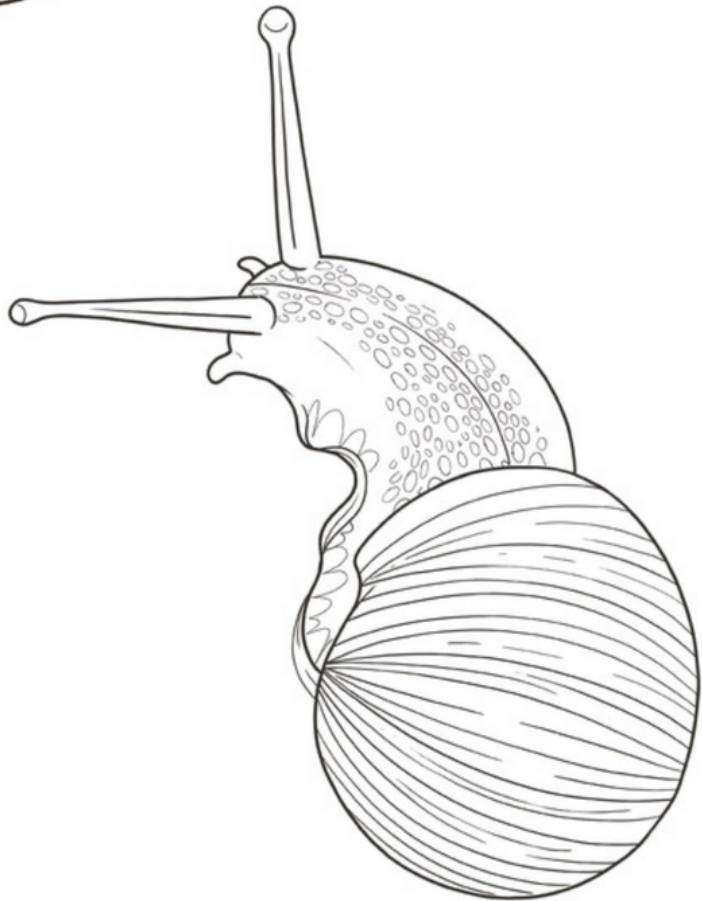
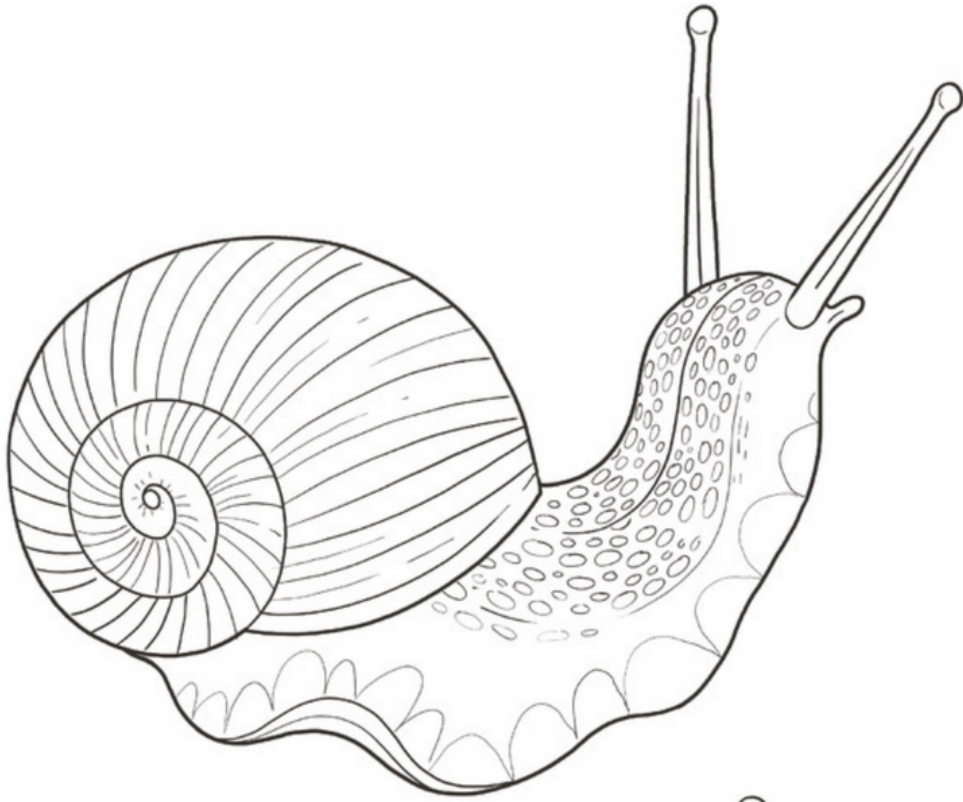


Illustration by @The\_Slime\_Scholar

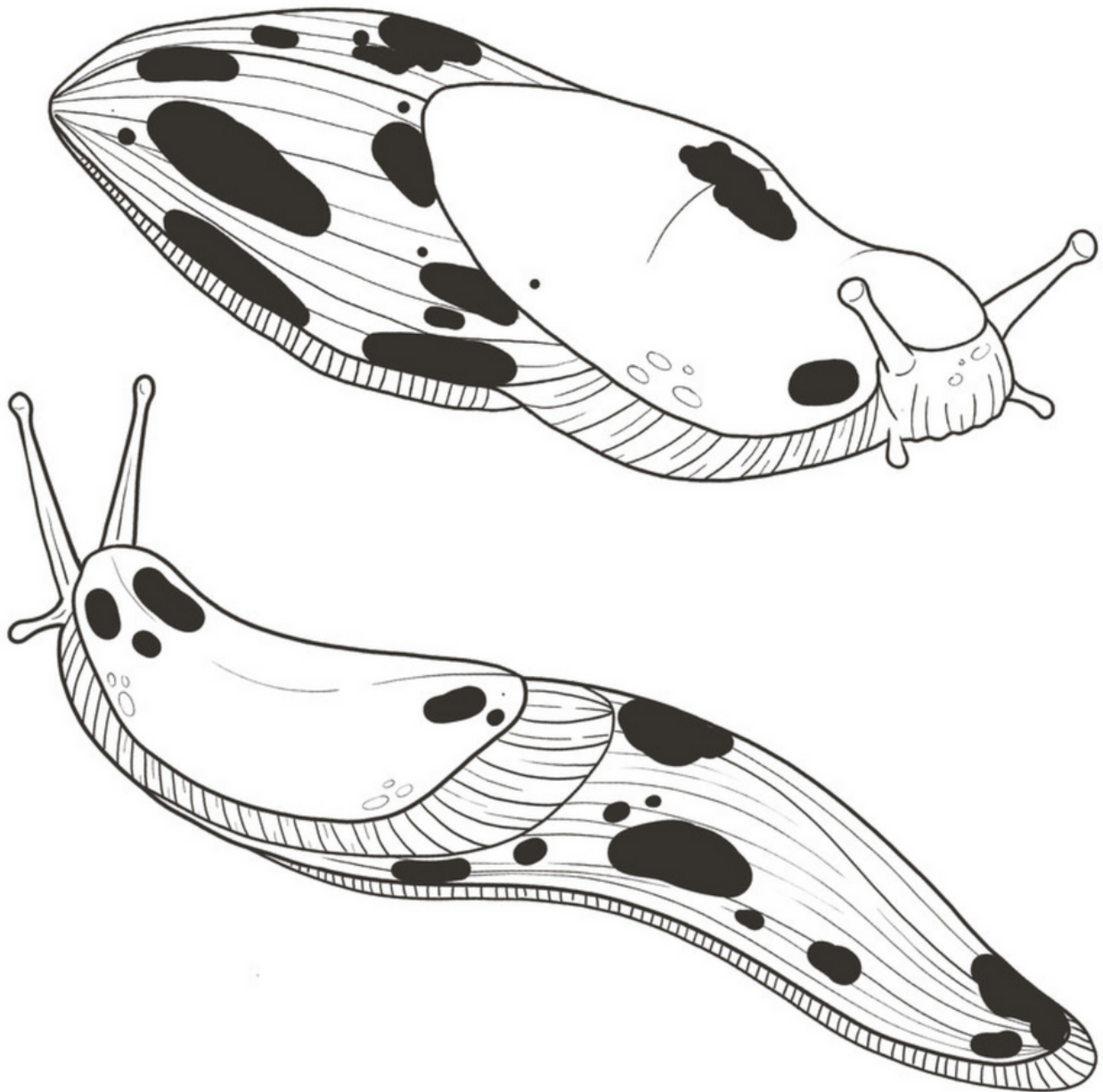


Illustration by @The\_Slime\_Scholar