

## DESIGNING THE CASE FOLDERS

Use this guide to help prepare the Case Folders used in the Explain and Extend sections of the “Crime Solving Insects” lesson. While there are only four different cases (one being used as a whole-class model), you may wish to make multiple copies of each depending on your class size and the amount of groups you expect to be at each station.

### Materials Needed

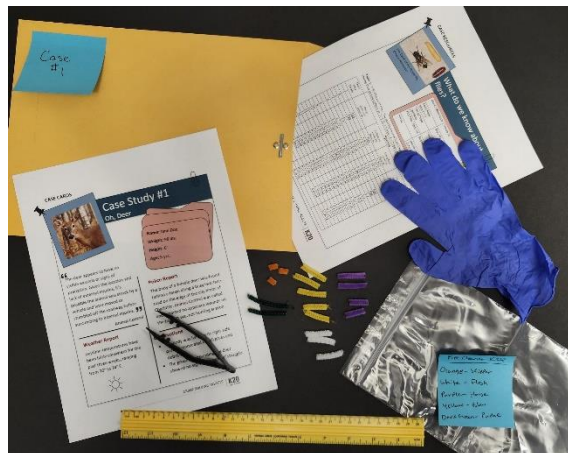
- Case Resources handout (attached; pages 2-3; one per folder)
- Case Cards handout (attached; pages 4-7; one case per folder)
- Rulers (one per folder)
- Colored pipe cleaners (at least 5 different colors)
- Plastic bags filled with appropriately measured lengths of colored pipe cleaners (1 for each case)
- Scissors to cut pipe cleaners
- Forceps or tweezers for each folder (optional)
- Plastic or latex gloves for each group (optional)
- Folders

### Preparing for the Lesson

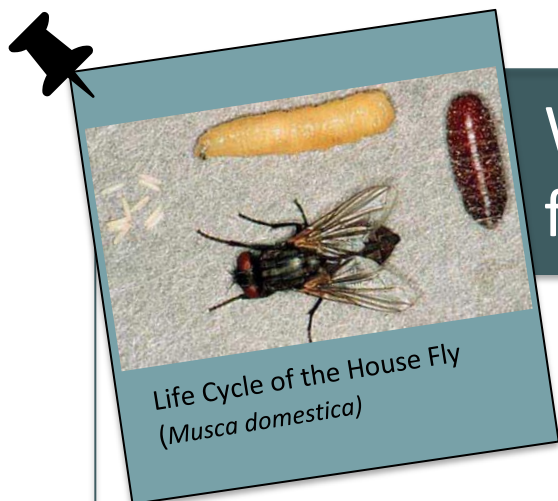
Prepare Case Folders for each case (see examples below). Consider making multiple copies of cases based on classroom needs.

#### *Case Folders contain:*

- Bug Bag of cut pipe cleaners (use Table 1 page 8). Label each bag with a case number.
- Case Cards handout (print one-sided)
- Case Resources handout (can be printed one-sided or double-sided)
- Ruler measuring millimeters
- Forceps or tweezers (optional)
- Plastic or latex gloves for each group (optional)



## CASE RESOURCES



# What do we know about flies?

## KEY

<i>Musca domestica</i>	House fly	Blue
<i>Calliphora vomitoria</i>	Blow fly	Yellow
<i>Sarcophaga carnaria</i>	Flesh fly	white
<i>Piophilina nigriceps</i>	Skipper fly	Pink
Pupae	species of pupae can't be determined except by size	Brown

**Table 1:** Life History of Flies. The development of body length (in millimeters) of some fly species during their metamorphosis at 72° F (L = Larvae, P = Pupae, A = Adult Fly).

Days after Death	Species			
	<i>Musca domestica</i> House fly	<i>Calliphora vomitoria</i> Blow fly	<i>Sarcophaga carnaria</i> Flesh fly	<i>Piophilina nigriceps</i> Skipper fly
1		Egg	L 9-11	
2	Egg	L 9-11	L 12-16	
3	Egg	L 9-11	L 17-20	
4	L 6	L 12-16	L 21-25	
5	L 6	L 12-16	L 26-30	Egg
6	L 7-11	L 17-20	L 31-35	Egg
7	L 12-16	L 17-20	L 36-40	L 3
8	L 17-20	L 21-25	L 41-44	L 3
9	L 21-25	L 21-25	L 44-46	L 4-6
10	L 26-30	L 26-30	L 44-46	L 7-9
11	L 31-35	L 26-30	P 38-40	L 10-13
12	P 26-29	L 31-35	P 38-40	L 14-16
13	P 26-29	L 31-35	P 38-40	P 13-15
14	P 26-29	P 31-34	P 38-40	P 13-15
15	P 26-29	P 31-34	P 38-40	P 13-15
16	P 26-29	P 31-34	P 38-40	P 13-15
17	P 26-29	P 31-34	P 38-40	P 13-15
18	A 30-32	P 31-34	P 38-40	P 13-15
19		P 31-34	A 42-45	A 16-18
20		P 31-34		
21		A 36-38		

# What *else* do we know about flies?

## SPECIES



**Table 2:** Ecological information for certain species of flies. The developmental delays/accelerations are given in number of days relative to the developmental schedule in Table 1 above.

		<i>Musca domestica</i> House fly	<i>Calliphora vomitoria</i> Blow fly	<i>Sarcophaga carnaria</i> Flesh fly	<i>Piophilina nigriceps</i> Skipper fly
Temperature (°F)	55°	delayed 4	delayed 4.5	delayed 4	delayed 3
	65°	delayed 4	delayed 3	delayed 2	delayed 1
	80°	accelerated 1	accelerated 2	accelerated 1.5	accelerated 1
	85°	accelerated 3	accelerated 4	accelerated 3	accelerated 2
Ecological Traits	Habitat	urban and rural	urban and rural	urban and rural	urban
	Lighting	full to partial sun	partial sun to shady	prefers sunny	prefers sunny
	Drugs	no effect	sensitive to effects	no effect	no effect

**Sources:**

Materials adapted from: Bambara, S., & Carloye, L. (2006). *Crime Solving Insects*. North Carolina Cooperative Extension Service.

<https://fyi.extension.wisc.edu/wi4hstem/files/2015/02/CSifinal.pdf>

Anderson, M., & Kaufman, P. (n.d.). *Common green bottle fly - Lucilia sericata (meigen)*. *Featured Creatures*.

[https://entnemdept.ufl.edu/creatures/livestock/flies/lucilia\\_sericata.htm](https://entnemdept.ufl.edu/creatures/livestock/flies/lucilia_sericata.htm)

Diaz, L., & Kaufman, P. (2013, January). *Sarcophaga crassipalpis Macquart - a flesh fly*. *Featured Creatures*.

[https://entnemdept.ufl.edu/creatures/misc/flies/sarcophaga\\_crassipalpis.htm](https://entnemdept.ufl.edu/creatures/misc/flies/sarcophaga_crassipalpis.htm)

Lewis, C., Kaufman, P. E., & Entomology and Nematology Department. (2010, January). *Cheese skipper - piophilina casei (linnaeus)*. *Featured Creatures*.

[https://entnemdept.ufl.edu/creatures/urban/flies/cheese\\_skipper.htm](https://entnemdept.ufl.edu/creatures/urban/flies/cheese_skipper.htm)

Sanchez-Arroyo, H., & Capinera, J. (2017, April). *House fly - musca domestica linnaeus*. *Featured Creatures*.

[https://entnemdept.ufl.edu/creatures/urban/flies/house\\_fly.htm](https://entnemdept.ufl.edu/creatures/urban/flies/house_fly.htm)

## CASE CARDS



# Case Study #1

## Canine Caper

**Name:** Terry  
**Weight:** 45 lbs.  
**Height:** 21"  
**Age:** 3 yrs.

“ I don't understand... She was just here this morning. Why did this happen? ”

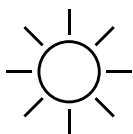
- Eyewitness

“ She was my best friend. She never hurt anybody. Who would do this? *This isn't fair.* ”

- Owner

### Weather Report

Daytime temperatures have been variable over the past three weeks, ranging from 75° to 94° F. Skies have been sunny.



### Police Report

The body of a large pit bull terrier was found inside a walk-in basement at a home in Cary. Maggots were found concentrated in the head and region behind the shoulder. The windows were closed, although the open curtains allowed sunlight to enter, and the air conditioner was set at 72° F.

### Observations

- No immediate signs of struggle or forced entry.
- Body found lying on its side near the center of the basement.



## Case Study #2

### Oh, Deer

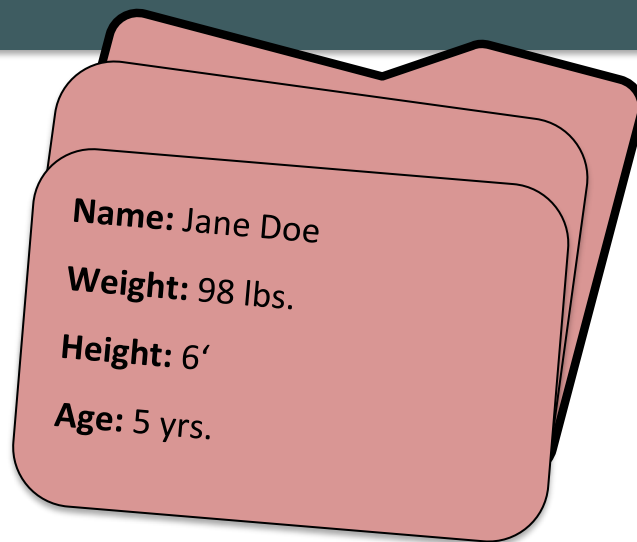
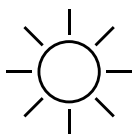


The deer appears to have no visible wounds or signs of predation. Given the location and lack of external injuries, it's possible the animal was struck by a vehicle and later moved or stumbled off the roadway before succumbing to internal injuries. ”

- Animal Control

#### Weather Report

Daytime temperatures have been fairly consistent for the past three weeks, ranging from 70° to 74° F.



**Name:** Jane Doe

**Weight:** 98 lbs.

**Height:** 6'

**Age:** 5 yrs.

#### Police Report

The body of a female deer was found behind a fence along a busy two-lane road on the edge of the city limits of Charlotte. Animal Control was called and reported no apparent wounds on the body. It was not hunting season.

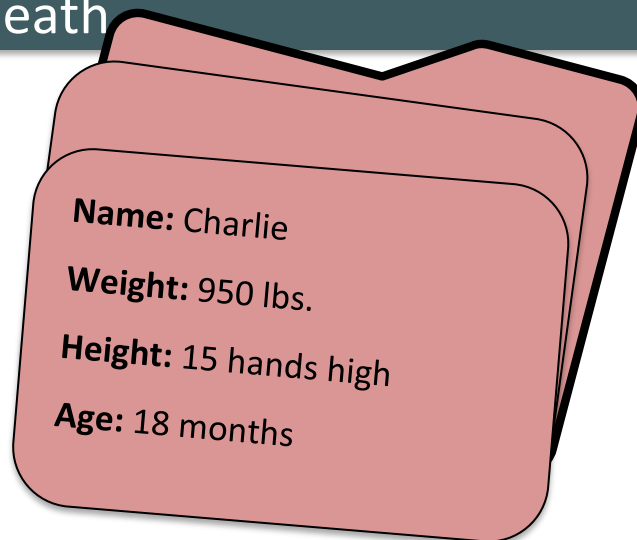
#### Observations

- The body was lying on its right side, partially concealed by tall grass and debris.
- The ground surrounding the deer showed no significant signs of struggle.



# Case Study #3

## Dandy's Death



“ I trusted that he was safe out here. If someone did this, they need to be held accountable. ”

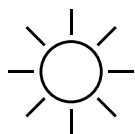
- Owner

“ I saw him yesterday, running around like normal. Nothing seemed wrong at all. ”

- Eyewitness

### Weather Report

Daytime temperatures have been unusually warm over the past three weeks, ranging from 84° to 86° F.



### Police Report

The body of a young male horse was found in a pasture in a small town near Wilmington. The autopsy from the vet school reveals that the cardiac glycoside, oleandrin (a powerful heart stimulant), was present in the body. Oleander is found in the oleander plant. Oleander is a common ornamental shrub in this area, but none grows within 200 feet of the pasture.

### Observations

- No visible external injuries.
- Found lying on its left side near the center of the pasture.





# Case Study #4

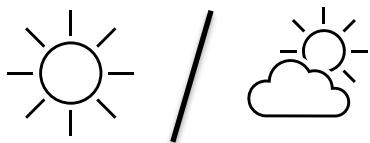
## Porky's Peril

“This is an unusual and troubling discovery for our community. We take matters of animal welfare seriously. I have full confidence in our investigators and forensic experts to determine what happened.”

- Mayor

### Weather Report

Daytime temperatures have been average over the past three weeks, ranging from 70° to 73° F. Temperatures in the woods would be approximately 5 degrees cooler due to the lack of sun in the shady environment.



**Name:** Hamlet  
**Weight:** 150 lbs.  
**Height:** 15" tall 3' long  
**Age:** 10 yrs.

### Police Report

The body of a large pot-bellied pig was found in a dense stand of evergreen trees far from any urban area in Buncombe County. Hairs round the pig's neck were worn away in a band pattern.

### Observations

- No immediate signs of predation or scavenging.
- Lying on its side, partially obscured by fallen branches.

**Table 1. Bug Bag content.** Cut pipe cleaners in lengths (in mm) to represent maggots and pupae collected from each body in each case. Cut several (2-3) of each length to make up the “sample” collected from the body. Remember, you may choose whatever colors you want for each as long as they are different, but all pupae are one color and the fly species for each pupae can’t be determined except by size. Also, be sure to update the “Key” on the Case Resources handout (attached in lesson resources and on page 2) to reflect the colors you chose.

Case Number	House Fly (mm)	Blow Fly (mm)	Flesh Fly (mm)	Skipper Fly (mm)	Pupae (mm)
<b>Case #1</b>	29 & 20	25 & 29	29	9	39
<b>Case #2</b>	6	—	15	—	—
<b>Case #3</b>	28	35	45	—	33
<b>Case #4</b>	6 & 19	18	9 & 15	5	—

### Teacher Tips

After trying different materials to represent the maggots and pupae (e.g. yarn and curling ribbon), we highly recommend using pipe cleaners for a few reasons:

1. They keep their shape which helps avoid confusion when students try measuring them (i.e. the yarn can be pulled taut vs loose)
2. The curling ribbon, when cut small, can be confusing to find the correct length vs width
3. Also, the flat curling ribbon can be harder to pick up and work with.

Additionally, consider laminating the Case Cards and/or Case Resources handouts for longevity and durability especially if you plan to use these resources in the future.