UNCW MarineQuest's Turtle Trash Collectors

2TC Maker Manual

Instructions for creating a model sea turtle for a simulated necropsy

Create by UNCW MarineQuest
10-1-2023

Welcome to the Turtle Trash Collectors Model Making Workshop!

This workshop is sponsored by the University of North Carolina Wilmington MarineQuest program and Center for Marine Science in partnership with NOAA and the National Marine Sanctuary Foundation.

The Turtle Trash Collectors (2TC) program is a UNCW MarineQuest environmental education initiative funded by the NOAA Marine Debris Program under grant #NA18NOS9990031. The primary goal of the program is to educate youth about the impacts of marine debris and encourage behavioral changes that can help reduce the generation of marine debris in the future. This is achieved by engaging youth in innovative necropsy simulations. From 2019 through 2021, programs were implemented both in-person and virtually, reaching 29,556 people (mostly youth) worldwide. A video, guide and resources for the program can be found on the NOAA website at: https://marinedebris.noaa.gov/activities/turtle-trash-collectors-program-activities-guide-and-resources

A key component of the program is the sea turtle model created for conducting a necropsy simulation. This was achieved by converting an existing plush toy into a dissectible model. After extensive review, we found the most accurate in size and detail, as well as best constructed toy is the Melissa & Doug lifelike stuffed plush green sea turtle. It can be purchased from their site, and is also available Amazon, and Ebay and other discount sites. https://www.melissaanddoug.com/collections/shop?search-input=sea+turtle&view=products&oq=Sea+turtle

This document serves as a guide for how to create a dissectible model out of a plush toy.

Necessary Supplies:

1	Plush sea turtle (Melissa & Doug giant sea turtle)
4.5 ft	2-inch wide heavy duty sewable Velcro (white or beige)
1 ft	½ inch wide sewable Velcro (white or beige)
2	sheets of heavy duty craft felt (~ 8 x 12 inches)
1	sheet of XL plastic needle point canvas (~21 x 13 inches)
6 ft	large diameter Loop Yarn (cream or similar color)
9 ft	poly chiffon tubular ruffle trim (ivory or white)
2 yds	combined yardage for different color and texture fabrics used for creating the organs *see suggestions in the section titled **Creating the Organs**
1 @	spool of heavy duty thread in a cream color and a red color
18 in	flexible upholstery foam (1/2 thick by 24 inches wide)
1.5 ft	3/8- or 1/4-inch-wide white elastic banding *optional, this is only needed if you wish to attach the muscles to body wall
8 - 10	small marine debris and turtle diet items to place in organs *see suggested items in **Attaching Organs of Digestive System Together**

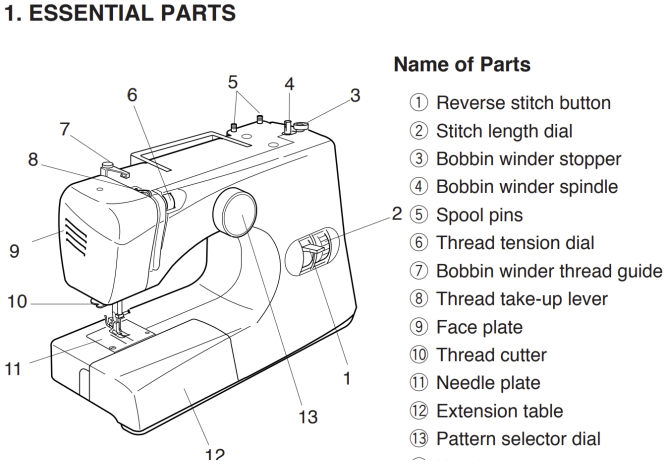
Necessary Tools:

Sewing machine in good working order
Bobbins for different colors of thread
Heavy duty sewing machine needles (rated for leather or heavy denim)
Heavy duty hand-sewing needles (you may find a curved needle helpful)
Good quality fabric scissors
Seam ripper

Ruler and/or measuring tape
Dowel for stuffing polyfill (chopstick or pencil works);
1.5 - 2 inch long straight pins
1.5 – 2 inch long safety pin (just need one)
Hot glue gun with glue sticks
canned air for cleaning plush fuzz out of machine;
tubes of sewing machine oil

Below is an image and diagram of the sewing machine that will be used during the in-person workshop. A manual can be found at: https://www.manualslib.com/manual/490497/Janome-Magnolia-7306.html

A simple sewing tutorial will also be provided during the workshop. There is also a video available on-line for a similar machine: https://www.youtube.com/watch?v=nbx8w-tTkBM



**If you are a novice seamstress and using this guide to create a model at home, you may want to search the web for a video tutorial to help you understand your machine, how to thread it properly, set the tension, set the stitch type and length, how to wind and insert the bobbin, how to lock a stitch in place and reinforce stitching at corners or tension points, how to sew with knits, etc…*

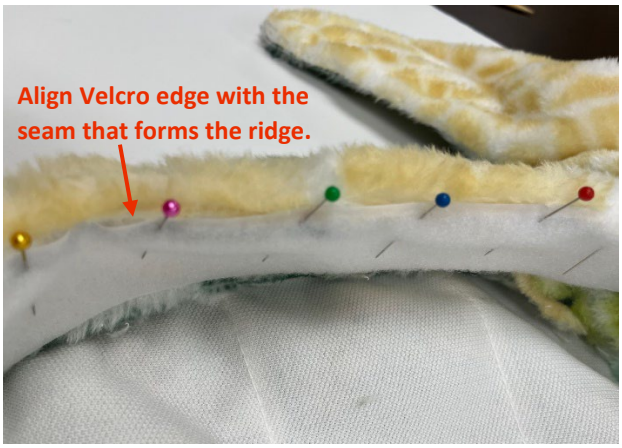
Gutting the plush turtle:

Notice that the side wall of the sea turtle has a definitive top and bottom ridge. These ridges along the side wall help provide the body cavity with structure, so we want to leave them intact. To open the plush turtle make a small incision between the plastron (belly) and the edge of the sidewall ridge that runs along the bottom side of the turtle. Carefully, insert your scissors and cut close to the ridge separating the plastron from the rest of the turtle. Try not to cut into the existing stitching that defines the belly side ridge of the sidewall. Set the belly aside for later reinforcement.

Remove the stuffing from the body cavity and bag it to use it later for stuffing the organs you create. You will also need to temporarily remove most of the stuffing from the 4 flippers and at least half the stuffing from the neck/head. This will make it easier to manipulate the turtle while using a sewing machine to reinforce the body cavity sidewall. *The stuffing in the head and flippers will be replaced once the body cavity has been reinforced.*

Reinforcing the body cavity:

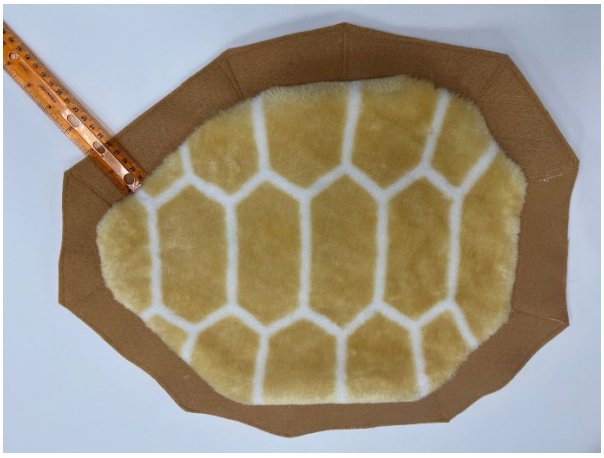
Sidewall: Pin the loopside of Velcro to the inner sidewall such that loops are exposed to the body cavity (the hookside of the Velcro will be used on the plastron later). Align the edge of the Velcro with the seam that defines the body ridge. The Velcro is best sewn to the plush turtle sidewall using a heavy-duty machine which the workshop leaders will manage for you. [If you make this at home with your personal machine, make sure it is set up for sewing thicker materials (tension, straight-stitch length, heavy duty thread, needles rated for sewing denim or leather) and take your time and move the bulky material slowly under the pressure foot as you sew]. The Velcro will only partially cover the openings to the flippers and neck. Workshop participants will need to hand sew patches over these openings to close them off *once the stuffing has been replaced in the flippers and neck/head.* We suggest using a piece of felt for the patches. You can also hot glue these patches into place.



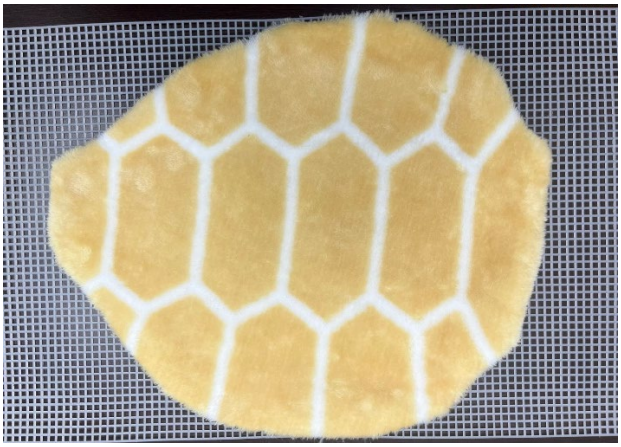
Body cavity floor: Trace the shape of the inner body cavity floor and cut a piece of the ½ inch upholstery foam to completely cover it. You can simply lay the foam on the floor so it can be removed during dissection, or you can use spray adhesive to permanently attach the foam to the floor of the cavity. Either way, the foam layer will give the turtle some structure and also illustrate body fat. It is off-white as this is a juvenile green sea turtle (based on the size of the Melissa & Doug plush turtle we used). If it were a larger adult turtle, the fat would be greenish in color.

Reinforcing the plastron (belly):

Lay the plush plastron flat on a piece of felt and trace around it. Using a ruler, make a new trace on the felt that is 2 inches larger/wider than the first one you drew. Take the hook side of Velcro and lay it in the area between the two traces. Because of the curvature of the traces, you will need to cut the Velcro into ~8 - 10 pieces. Sew these in place being careful to abut the edges and secure all the way around each piece of Velcro.



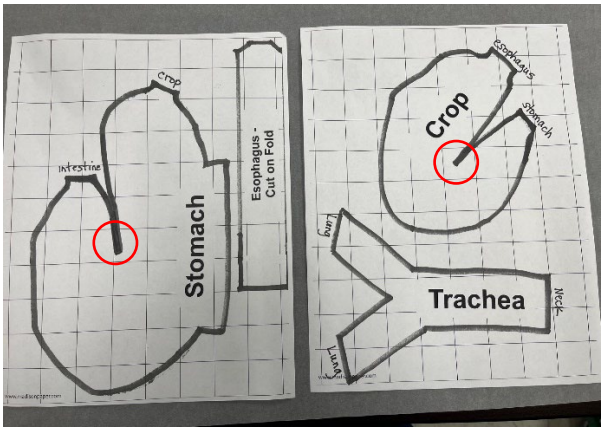
Lay the plastron onto an extra-large sheet of plastic cross stitch grid and trace around it. Using a ruler, make a new trace on the plastic grid ½ inch inside of the original trace. Cut the plastic grid along this new smaller, inner trace.

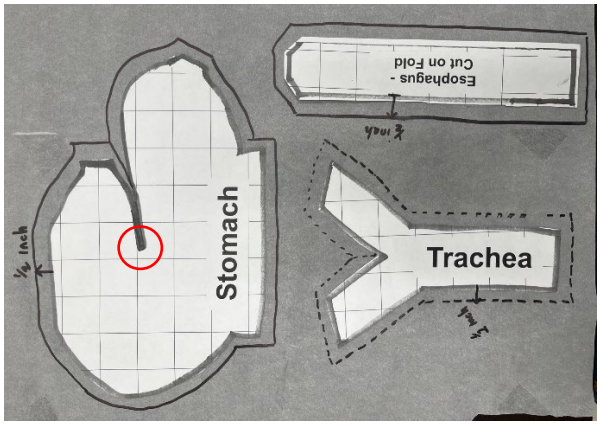


Carefully lay the plush plastron onto the felt, situating it over the space defined by the Velcro border you created. Pin the plastron into place and sew it to the felt ¼ inch in from its edge, leaving a 2-inch opening at one end. Carefully roll the plastic grid you cut into a tube and insert it into the opening (noting its head to tail orientation) and then maneuver to unroll it so that it lays flat inside the plush plastron/felt pocket. Sew the opening closed. When done, the reinforced plastron should look like the image above. The Velcro border will allow you to replace the plastron/belly on the turtle, attaching it the body cavity inner side wall, and hold all the organs you create securely in the body cavity.

Creating the organs:

Patterns for the organs are provided in this manual. When you print them, select the Fit to Fill Page option on your printer so that the organs are the appropriate size. The grid that they are on has 1 inch squares. Trace them onto tissue paper. Using a ruler, retrace the organs ½ inch wider. This extra ½ inch provides the seam allowance when you sew along the original trace. *Note: no pattern is provided for the small and large intestines.* They will be made from 4 yards of loop yarn and 3 yards of chiffon ruffling.





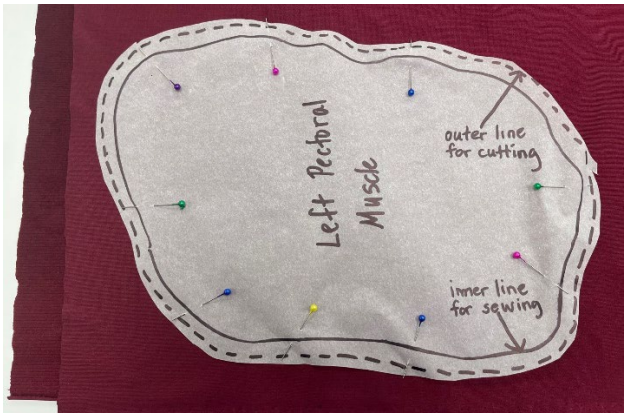
The red circle indicates a point in the pattern where the material requires reinforcing the stitching to prevent tearing.

To help make the model more visually realistic and identifiable, different colored and textured fabrics are suggested for each organ. The following suggestions are the materials that will be used during the in-person workshop but you can use other fabrics of your choosing:

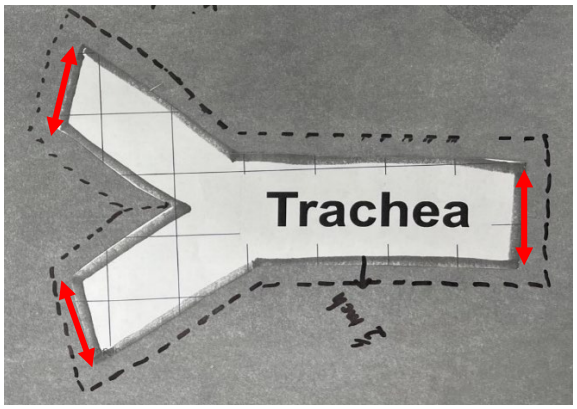
- Esophagus — apricot wavy crepe
- Crop — grey textured knit
- Stomach — olive textured knit
- Small intestine — looped yarn (cream) 6 ft
- Large intestine — chiffon ruffle trim (ivory) 9 ft
- Liver — maroon knit
- Heart — red crushed velvet
- Trachea — Ivory pleated knit
- Lungs — rose textured muslin
- Pectoral muscles — wine textured knit
- Pelvic muscles — wine textured knit

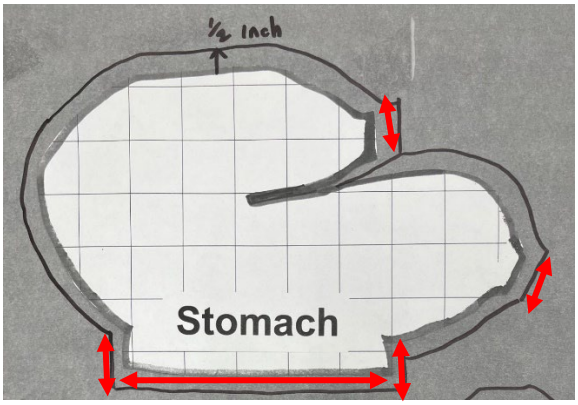
patch to sew on flipper

Cut out the enlarged tracing of each organ pattern and pin it to the appropriate material. The material will need to be folded or doubled so that when you cut out the pattern you will have 2 pieces for each organ. Fold the material so that the finished/ right-side of the material is inside the fold and the unfinished/ wrong- side is facing outward. Pin the pattern folded material and carefully cut it out. *Note: when using stretch fabric it is particularly important to pin the material together well. Generally, more pins are better! Then sew slowly and remove the pins as you go. This will help the pattern you cut out retain its shape.*



While sewing the 2 pieces of each organ together, leave a small opening approximately 1.5 to 2 inches wide and then turn the organ right-side out (*the only exception is the trachea. Sew the inner and outer long sides of the Y shaped pattern together leaving the 3 short ends open. This is necessary in order to be able to turn the inside/finished material outward*). Once you stuff the organ with polyfill (lungs, muscles, heart, liver) or marine debris (crop, stomach, large intestines) you will need to hand sew the openings closed – *with one exception* - the stomach will remain open along the area indicated by the rectangular edge and be reinforced with a thin strip of Velcro so students can pen and close it to remove contents for analysis.



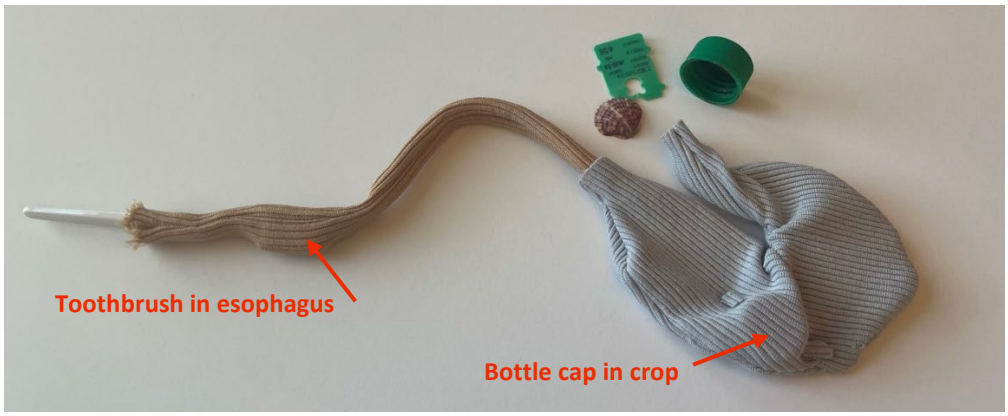


Red arrows indicate areas that need to remain open.

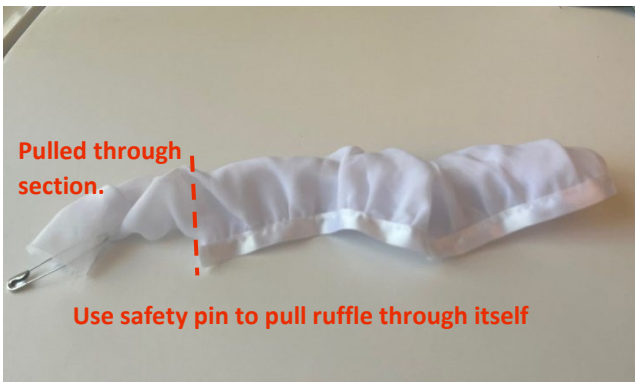
When sewing the stomach together, leave the protruding rectangular edge open on the short and long sides. Turn the organ right-side out. Cut strips of Velcro to fit the length of the rectangular edge (it will be the right-side of the material) and pin the loop side to one edge and the hook side to the other. Sew the Velcro in place. Fold these edges inside the stomach and sew them to the respective side wall of the stomach. This Velcro opening will allow the students to open and reseal the stomach.

Attaching organs of digestive system together:

To create the digestive tube, you will attach the esophagus, crop, stomach, small intestine and large intestine to each other in the order listed. The esophagus may be left empty, or a piece of straw or toothbrush can be enclosed in it. Sew one edge to the top opening of the crop as indicated on the pattern. This will close off the opening (*once the entire digestive system is assembled, the open end of the esophagus will be attached inside the neck of the plush turtle and the opening closed off*). Place marine debris in the crop (bottle cap, small seashells, etc…). Attach the bottom opening of the crop to the top opening of the stomach, closing this opening. The contents of the crop cannot be removed but should be identifiable by feeling the organ.

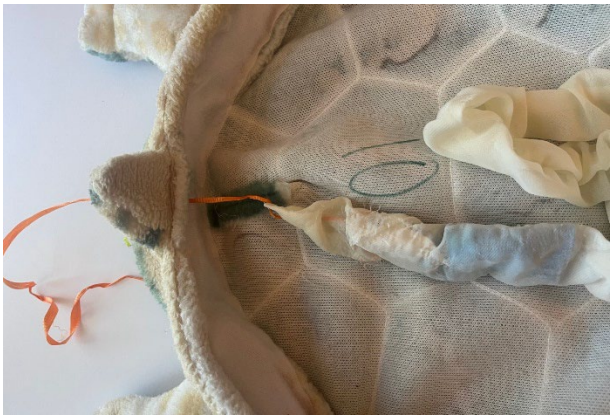


Next, attach the bottom opening of the stomach to one end of the small intestine (loop yarn) by placing about an inch of the yarn inside the stomach opening. This will close off the stomach; however, the stomach can be opened via the Velcro edge. Suggested marine debris to place in the stomach includes a plastic bag, snack wrap, small plastic toy, small latex balloon, fishing line etc… You can also put representation of a turtle's diet in the stomach, such as a toy jellyfish, seaweed, squid, etc…



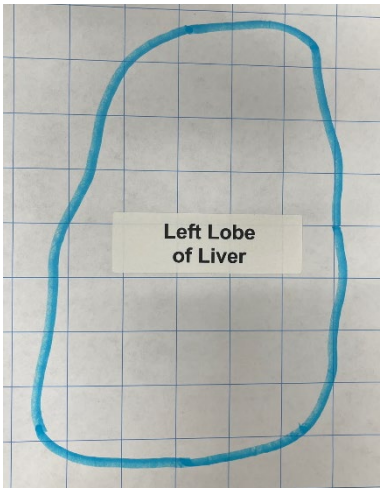
Find the other end of the small intestine/loop yarn that will be attached to the large intestine/chiffon ruffle trim. Prepare the large intestine by first inverting the ruffle tube. This can be done by attaching a large safety pin to one end and then pushing it through the ruffle tube and out the other end. This will narrow the width of the ruffling making it more realistic. Note: *if the ruffling still seems too wide, pin the seamed edge in place and sew it down; then invert the ruffle tube a second time.* Now it can be attached to the small intestine loop by inserting an inch of the loop yarn into the opening at one end of the ruffle and sewing the opening closed.

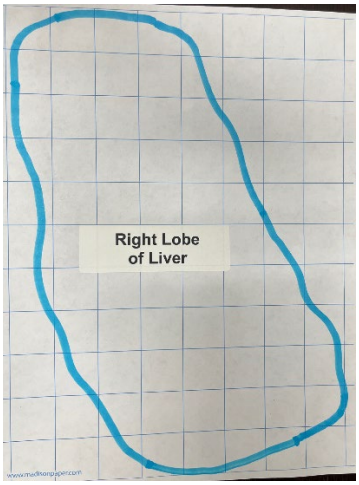
Carefully insert a piece of mylar balloon into the other end of the large intestine/ruffle tube and leave the attached ribbon extending out of the opening. When you are ready to attach the digestive system (end of large intestine) to the plush turtle body, make a tiny incision in the side wall of the body just under the tail. Insert the balloon's ribbon through this hole so that it protrudes outside of the turtle and then sew the open end of the large intestine to the body wall at the incision site.



Placing the liver:

The liver is the largest organ associated with the digestive system. It has two large lobes of different sizes. Cut, sew, stuff and close each lobe. Then hand sew the two lobes together as shown below.



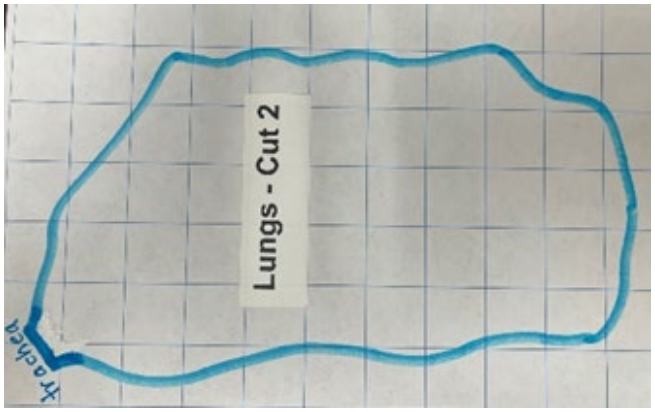


The liver is highly vascular and connects to the circulatory system via a hepatic vein and artery. It also connects to the digestive system through a system of hepatic ductules. For our purposes, the liver is not physically connected to either system in our model; however, you can connect it to the stomach and the duodenum (first section of the small intestine) if you wish. We suggest using something like yarn or embroidery thread to represent the hepatic ducts. The liver is situated ventrally (closest to plastron) in the body cavity, deep in the pectoral region and under the pectoral muscles and bordering either side of the digestive system.

Attaching lungs and trachea for respiratory system:

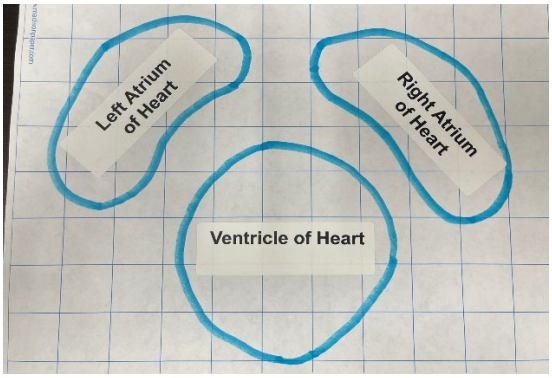
After sewing the trachea, invert it carefully. This is a little tricky and takes patience. Using a thin chopstick or pencil to push the material through one arm of the trachea can help with the inversion.

As the pattern indicates, you need to cut it out twice, each time on the folded material so you have 2 pieces to sew together for each lung. Sew around the lung leaving the end marked trachea open. Stuff each lung with a small amount of polyfill to establish the shape of the organ but still leaving it flaccid. This will represent the lungs of a deceased sea turtle. Insert each of the two ends of the trachea into a separate lung and sew the junction closed. Sew the single end of the trachea into the neck behind the esophagus. The lungs lay atop the fat layer covering the floor of the body cavity.



Assembling the heart:

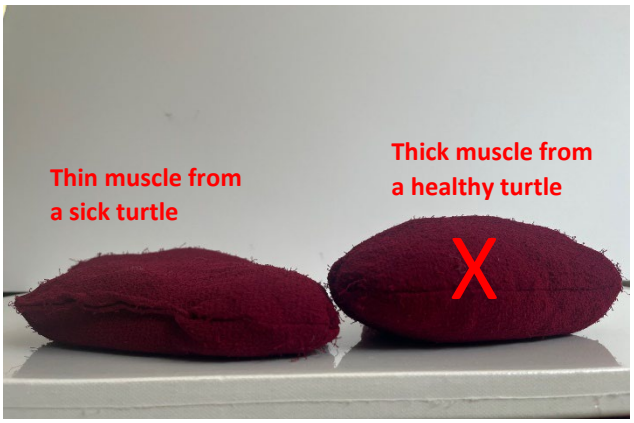
As this project is focused on how marine debris most impacts a sea turtle, the circulatory system is only minimally represented by the inclusion of a heart. To create the heart - cut out, sew together, stuff with polyfill and then hand sew the openings closed on each of the 3 individual pieces. To assemble the heart, hand sew the two smaller lobes along the top of the larger main lobe.



The heart is situated centrally below/behind the pectoral muscles and sits atop the connection of the crop with stomach, nestled between the lobes of the liver.

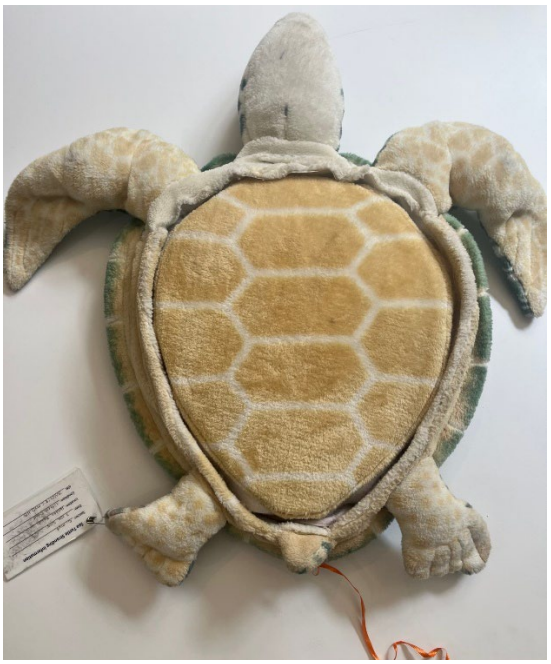
Assembling the musculature:

Cut, sew, stuff and close the pectoral and pelvic muscles. Because our model represents a sea turtle that was under stress, we suggest making the muscles thin. This can represent the physical condition of a sea turtle that was starving, sick, inured or freezing etc… The muscles are positioned in the body cavity so that they are the first things seen when the plastron is removed. In a real sea turtle, they would be attached to the skeletal system by tendons and ligaments. For our purposes, they are simply laid atop the other organs for easy removal during dissection. If desired, the muscles could be attached to the inside of each of the 4 flippers using short lengths of elastic.

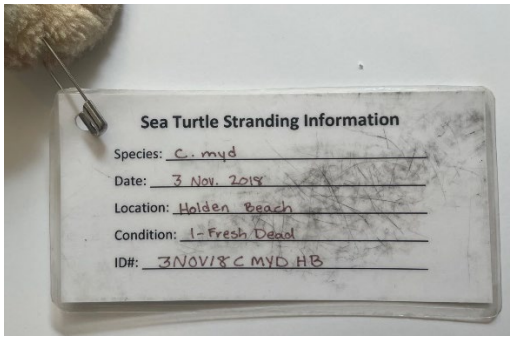


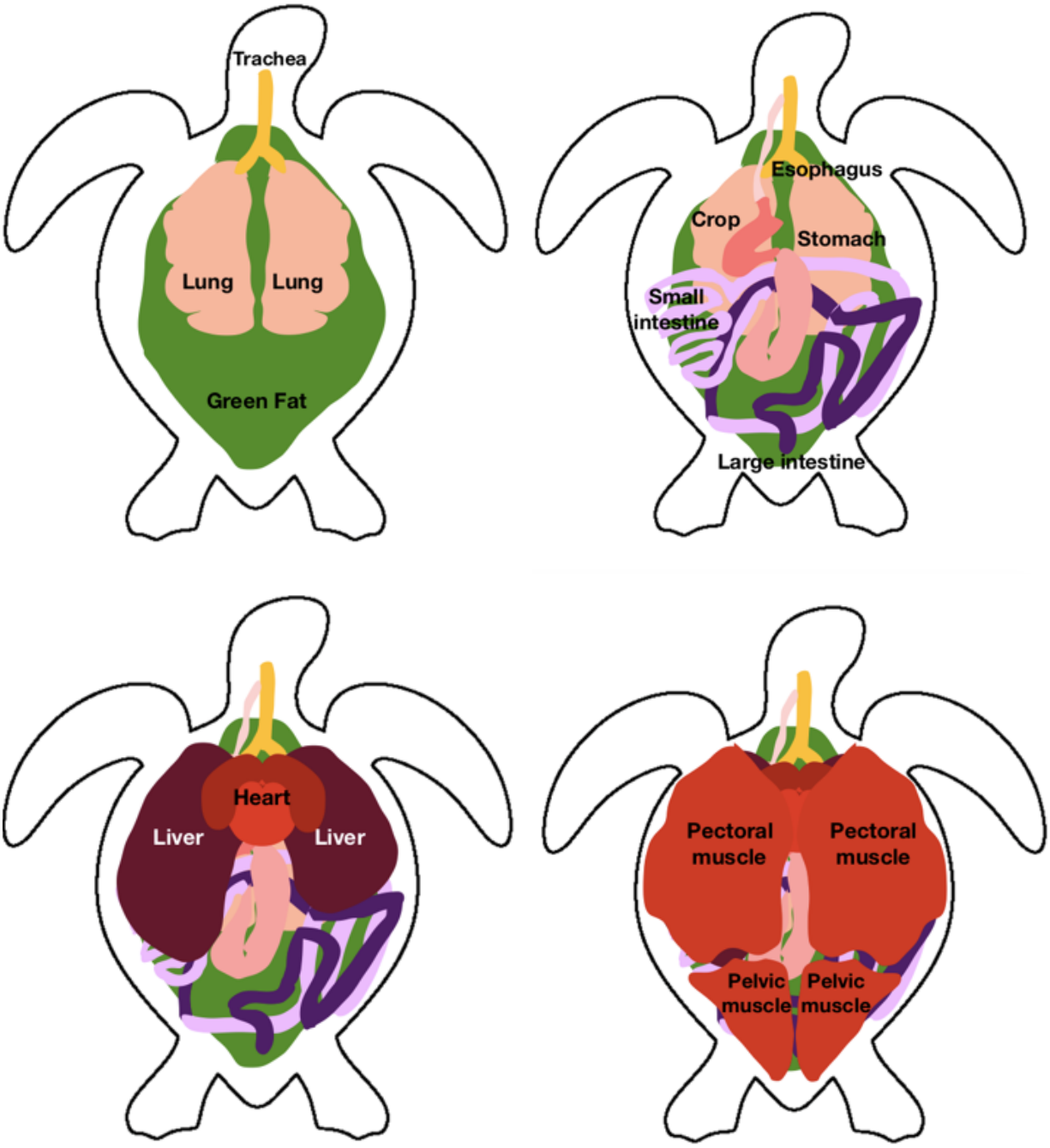
Assembling the dissection model:

Now that all the organs are complete, you can assemble your model (*the diagrams on the next page will help*). The trachea and lungs lie atop the fat layer. The digestive tube/system lies on top of the respiratory system. The liver lies on top and to either side of the digestive system. The heart lies on top of the crop/stomach connection and between the lobes of the liver. The pectoral (upper half of body cavity) and pelvic muscles (lower half of body cavity) cover the other internal organs. The plastron seals the body cavity. To place the plastron, carefully center and lay it over the open body cavity. Gently push the hook Velcro edge of the plastron down into the body cavity so that it attaches to the reinforced body wall with the loop Velcro. Go all around the plastron sealing the body cavity.

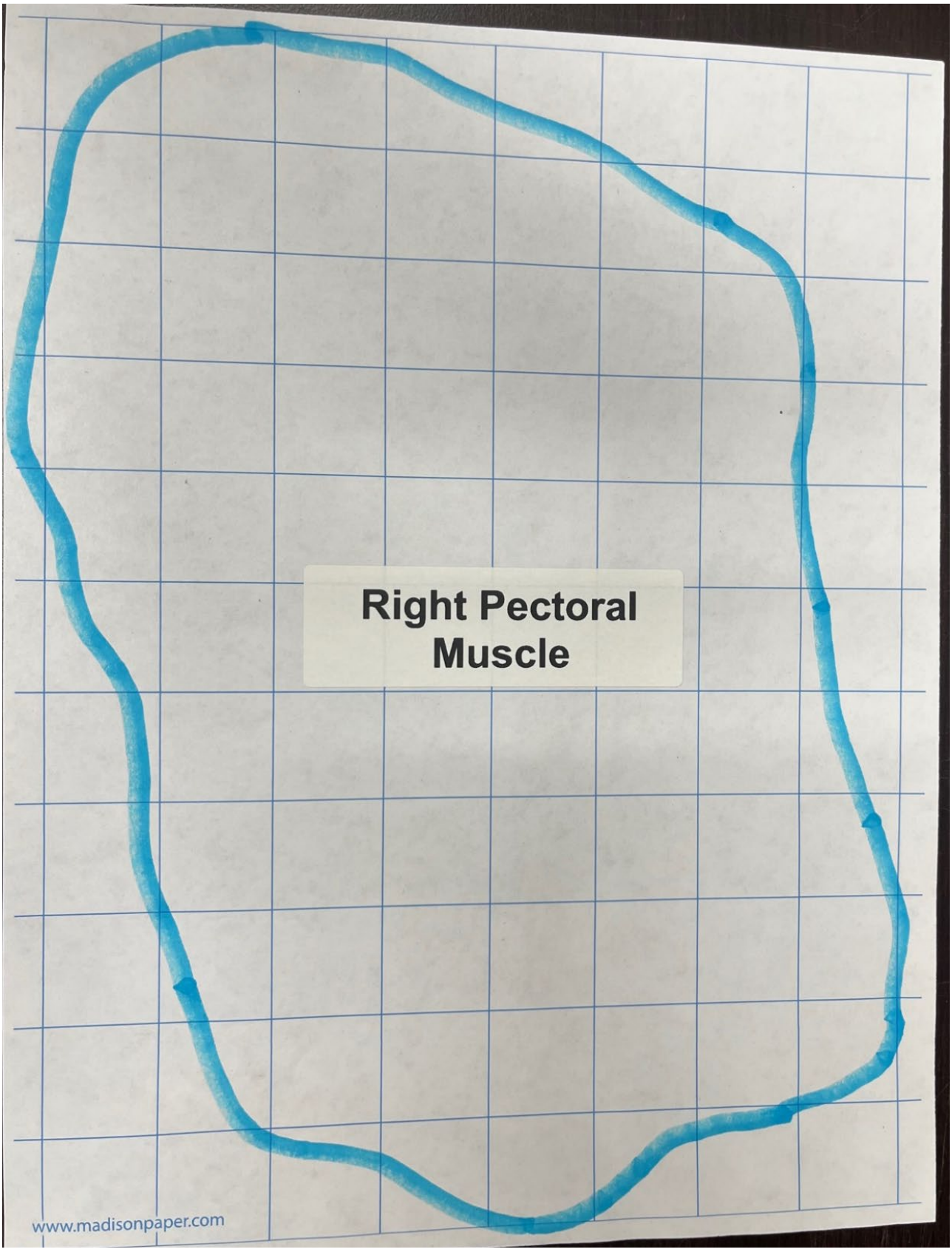


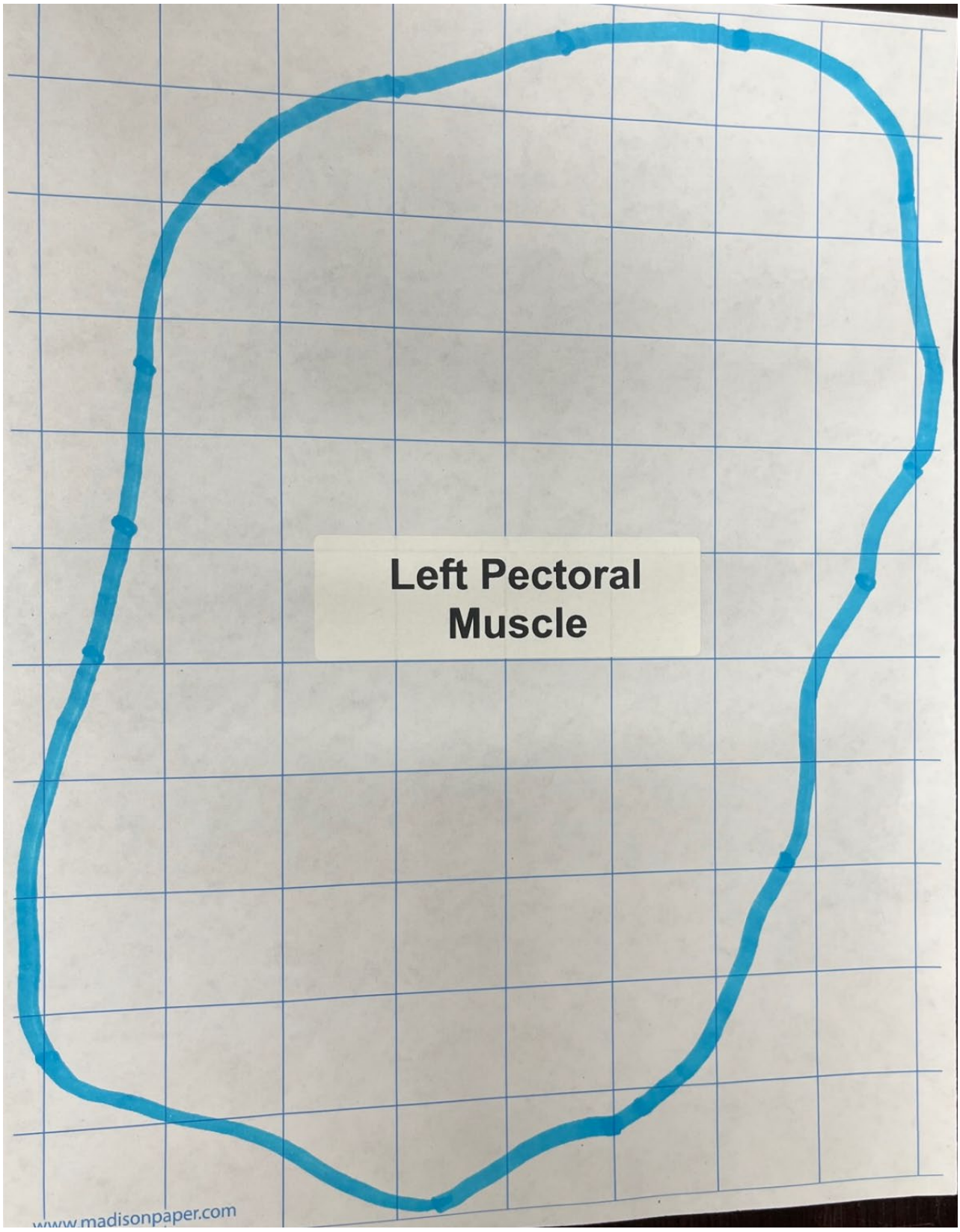
The final thing to add to the turtle is the MarineQuest patch which we provided during the workshop. If you make yours at home, please contact us at marinequest@uncw.edu and request a patch for your turtle. We appreciate you doing this to help us maintain creative association with this fantastic education tool.
You can also add a tag to simulate how a turtle in need would be identified once it is found in nature, and add a scar to the carapace, fake barnacles, etc… be creative!





Note: We did not include any components of the urogenital or reproductive systems in our model. However, kidneys can easily be incorporated. The kidneys of the green turtle are flattened, lobed and closely applied to the posterior wall of the body cavity. We suggest using a dark purple dimple dot or "dinky" material. It has a bumpy texture. To simulate a mature female with eggs, use a pair of opaque white or beige toddler tights and to make the ovary, cut off the legs and stuff with ping pong balls. Knot the open end of the legs and place one on either side along the inner wall of the back of the sea turtle. These would like parallel to the kidney.


Right Pectoral Muscle
www.madisonpaper.com


Left Pectoral Muscle
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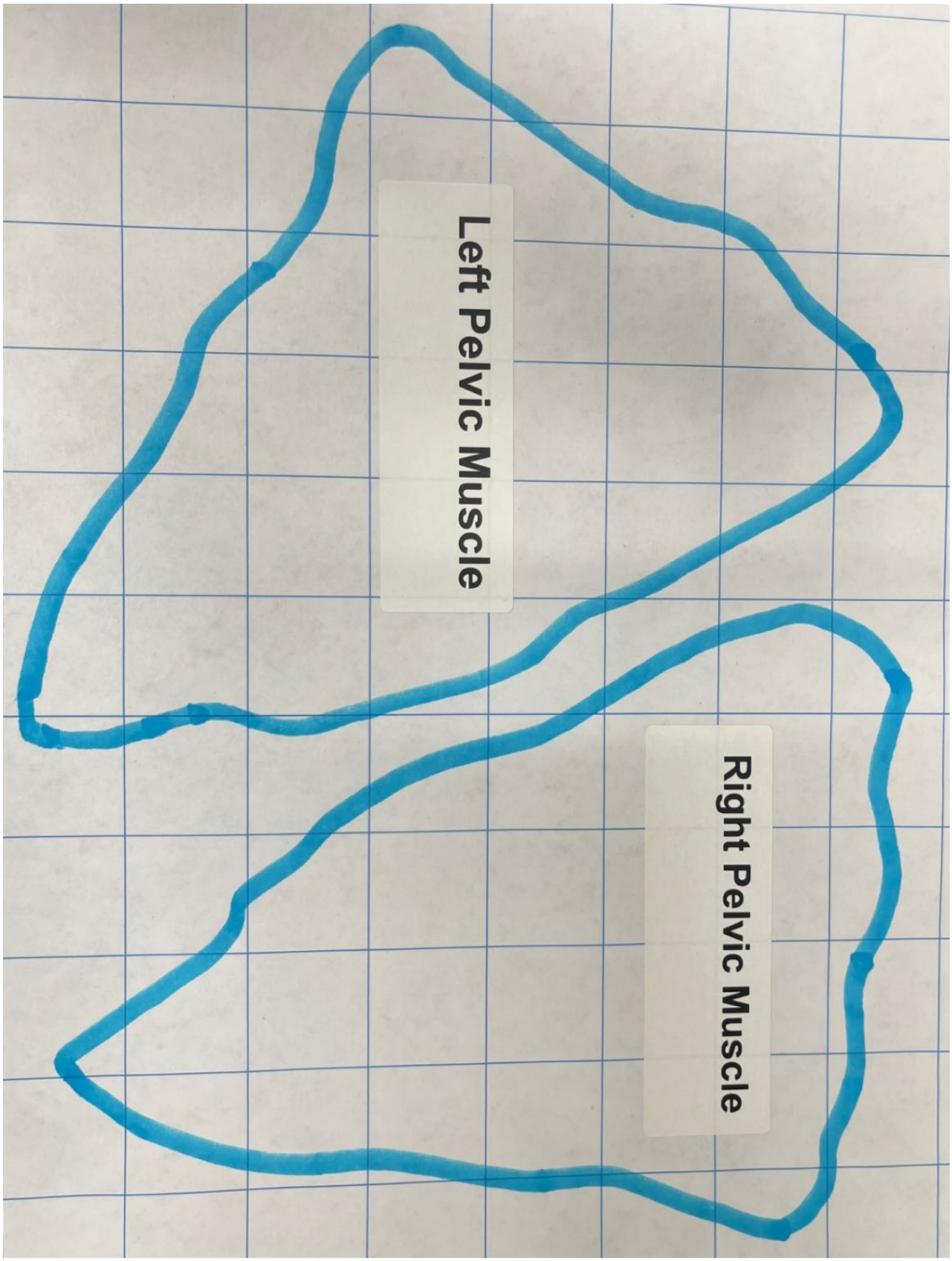
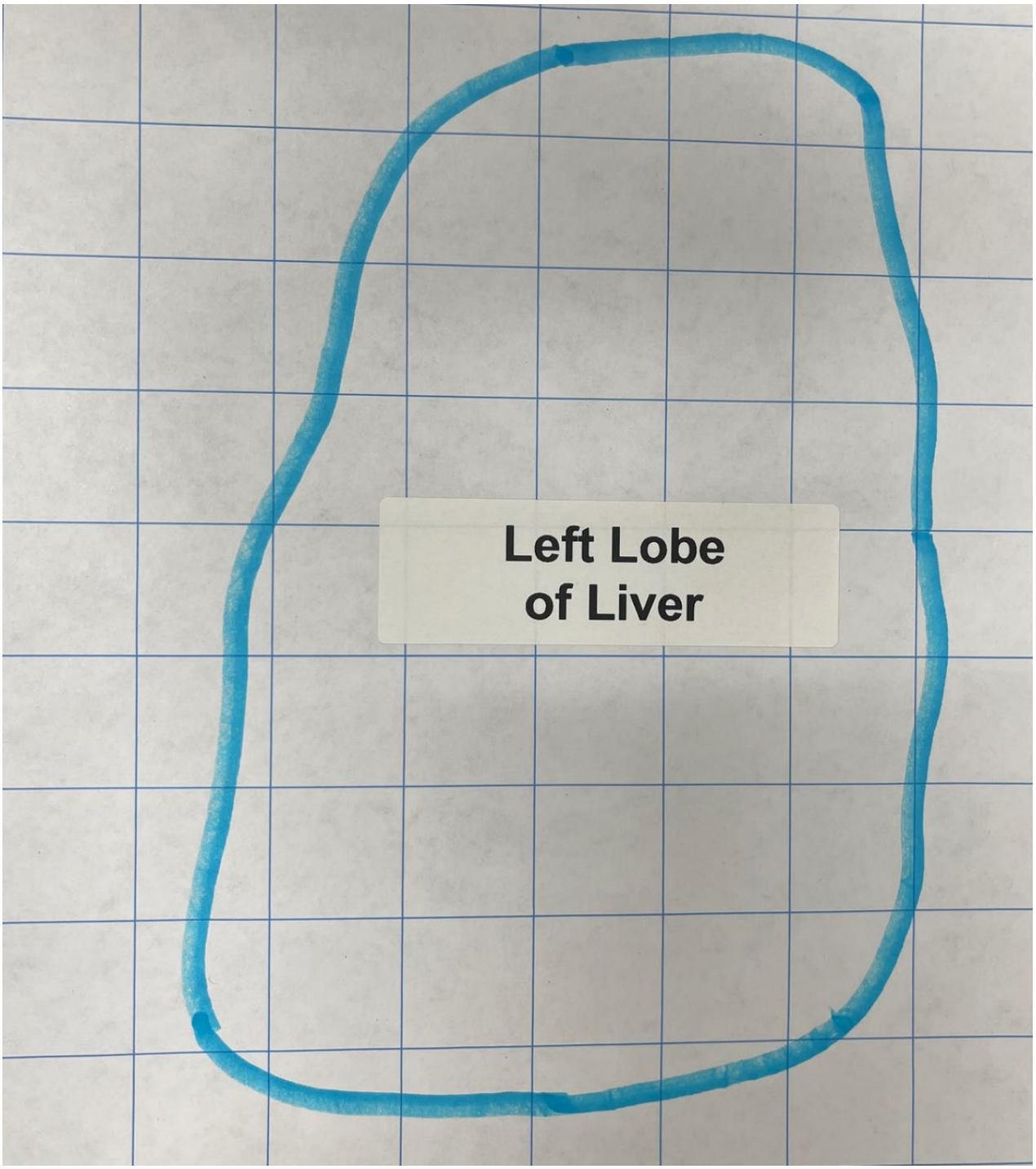
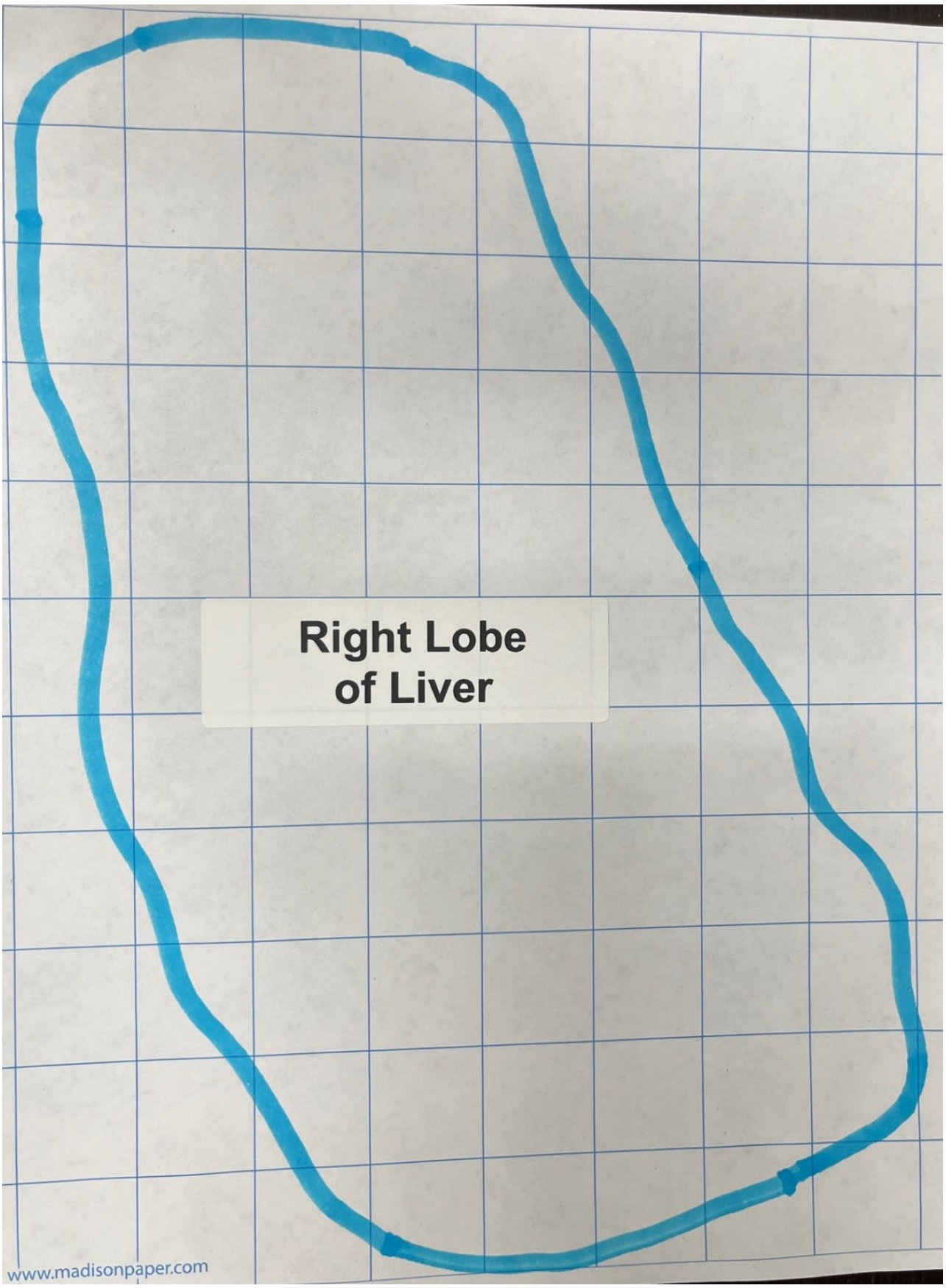
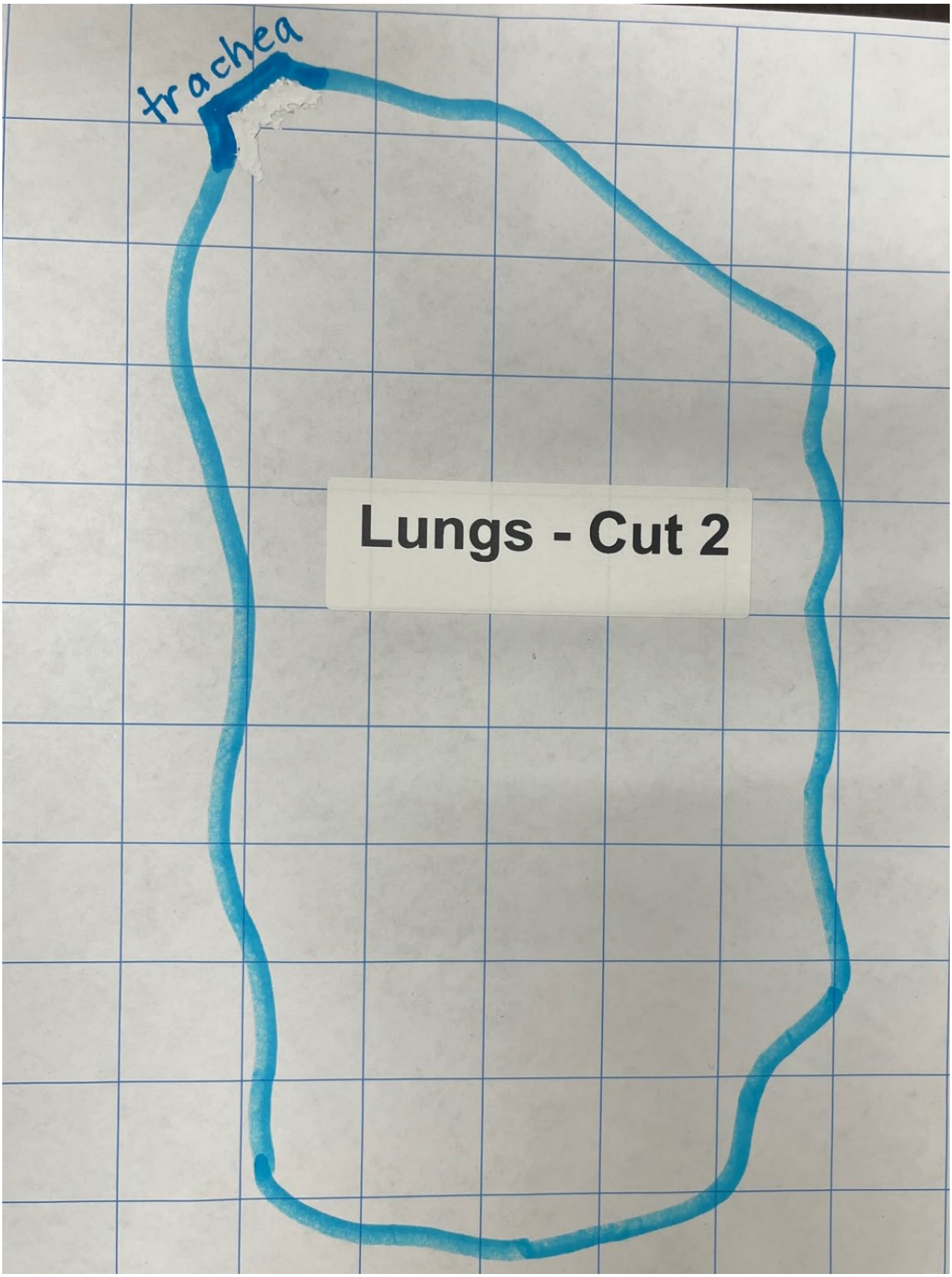
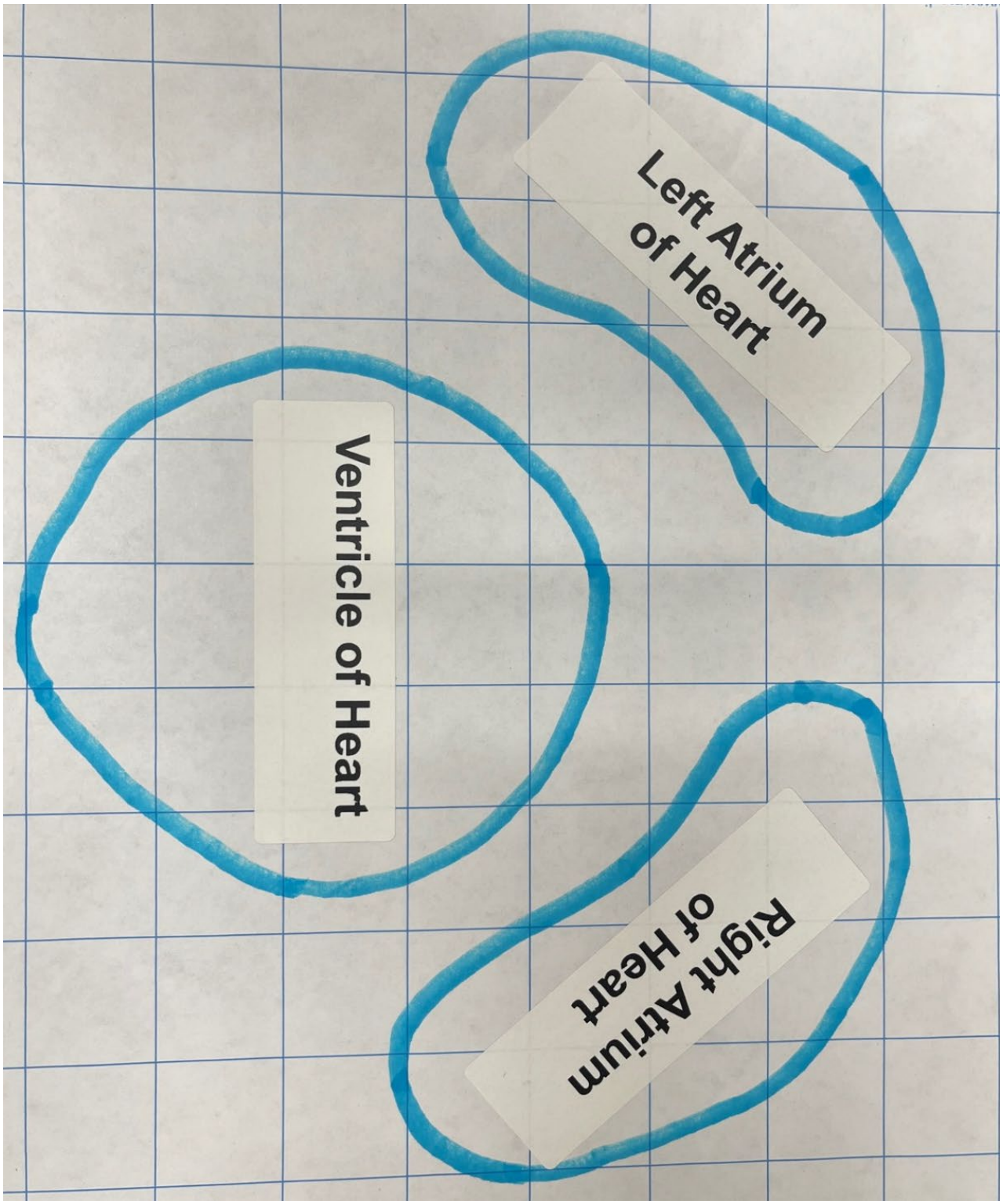
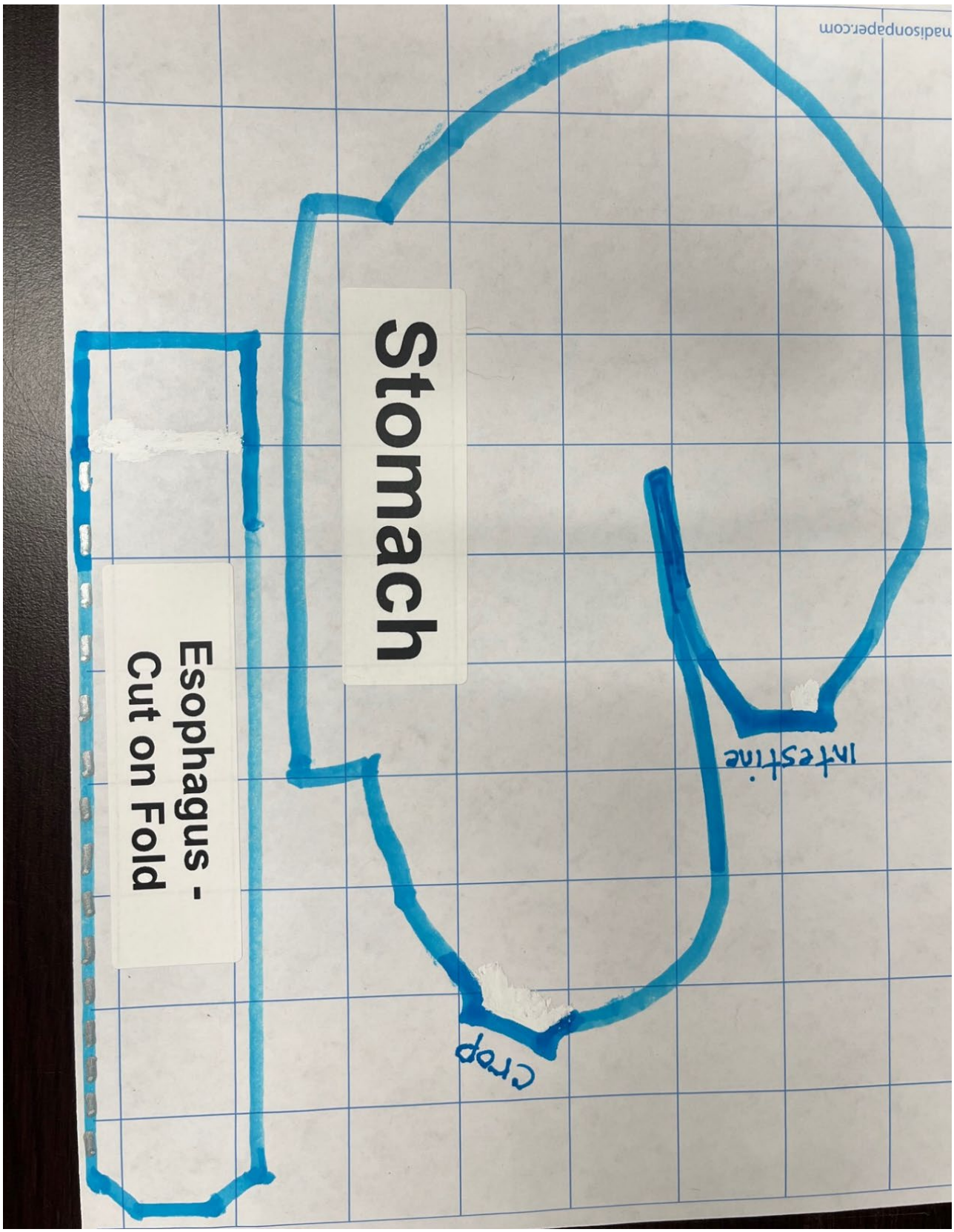

Left Pelvic Muscle
Right Pelvic Muscle

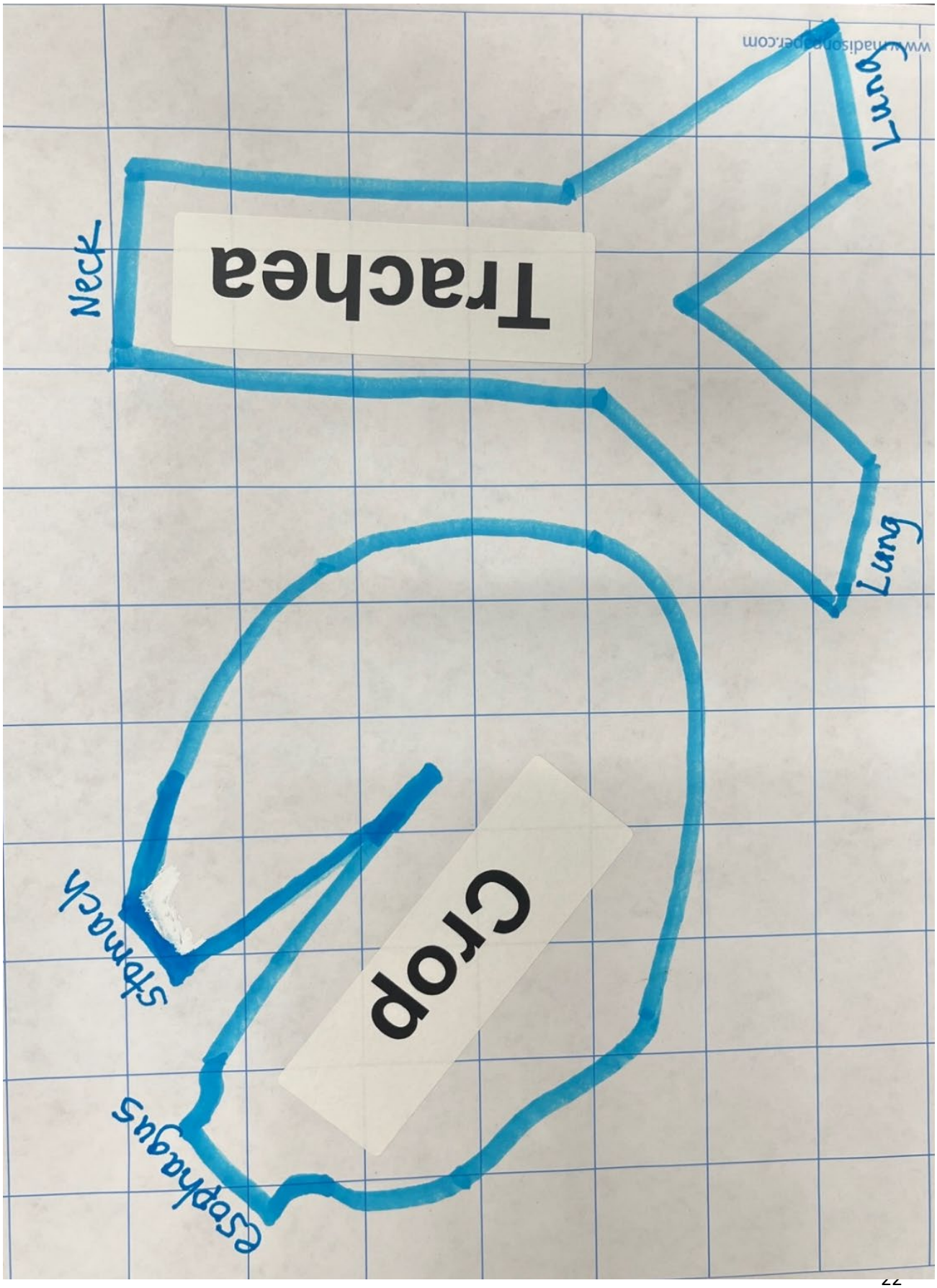

Left Lobe
of Liver

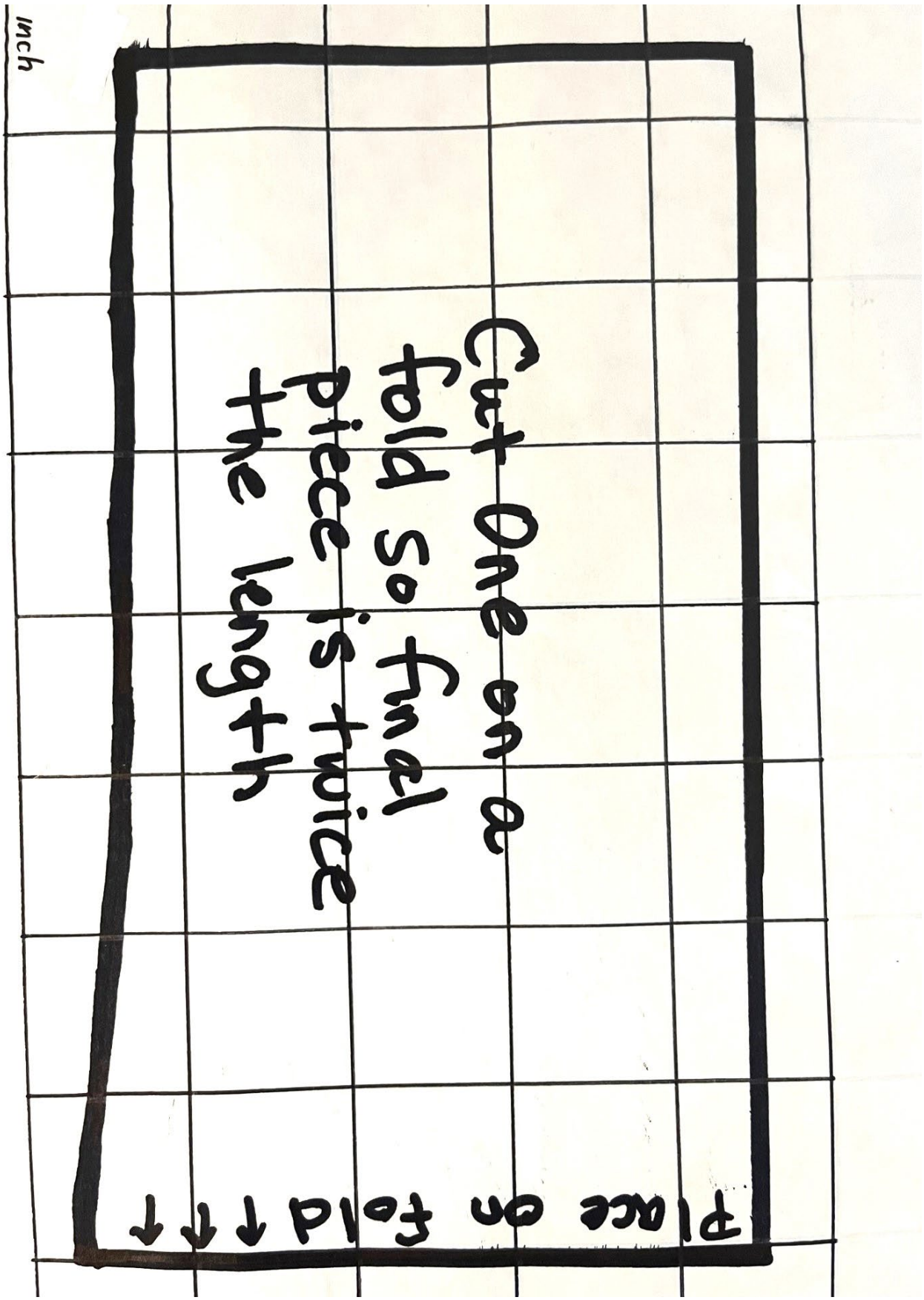

Right Lobe
of Liver
www.madisonpaper.com


trachea
Lungs - Cut 2


Left Atrium of Heart
Ventricle of Heart
Right Atrium of Heart


Stomach
Esophagus -
Cut on Fold
Crop
Intestine
madisonpaper.com


Neck
Trachea
Lung
Lung
Crop
Stomach
Esophagus


inch
Place on fold
Cut One on a fold so final piece is twice the length