**Laminar gelatin tanks**

Designed by Madeline Frey and Grant Lockridge in 2022, for use in postdoctoral research by Amberle McKee.

Motivation:

Observation of small burrowing animals is very difficult due to the opaque nature of sediment. Thin aquaria (also called "ant farms") are commonly used to restrict animal movement, but rigid aquarium walls modify the physical properties of the sediment inside, with the proportion affected increasing as the width of the tank decreases (Dorgan et al. 2006). Gelatin is a transparent analog for mud, and has been used to observe worm burrowing behavior (Dorgan

et al. 2005). Burrowing worms can be detected from the pressurization of pore water in sediment (Wethey and Woodin 2005). Worms display patterns of pressurization that differ with depth, but those patterns have not been paired with behavioral observations. Gelatin is a homogeneous gel without pores, which prohibits the measurement of pressure patterns. Laminar tanks use gelatin and flexible silicone to reduce wall effects and create a thin area to observe worms in.

Materials:

½” HDPE: McMaster [**8619K474**](https://www.mcmaster.com/8619K474)

3/16” Cast Clear Acrylic: [**8560K214**](https://www.mcmaster.com/8560K214)

2-¼” 10-32 Screws: [**91735A609**](https://www.mcmaster.com/91735A609)

10-32 Nuts: [**90242A333**](https://www.mcmaster.com/90242A333)

Clear Silicone Sheets: [Amazon](https://www.amazon.com/Silicone-Rubber-Sheet-Flexible-12x20x1/dp/B071KQZBVM?pd_rd_w=gvrOs&content-id=amzn1.sym.bc622850-a717-4d94-96c3-7cc183488298&pf_rd_p=bc622850-a717-4d94-96c3-7cc183488298&pf_rd_r=KMZND5BSKY9V6B8F41B6&pd_rd_wg=bCmQk&pd_rd_r=d73e5c94-5218-4b4e-8d25-2a86dfa45a6a&pd_rd_i=B071KQZBVM&psc=1&ref_=pd_bap_d_rp_1_t)

Silicone Sealant: [Amazon](https://www.amazon.com/Clear-Aquarium-Silicone-Sealant-Cartridge/dp/B00EZB1QQ2?pd_rd_w=gvrOs&content-id=amzn1.sym.bc622850-a717-4d94-96c3-7cc183488298&pf_rd_p=bc622850-a717-4d94-96c3-7cc183488298&pf_rd_r=KMZND5BSKY9V6B8F41B6&pd_rd_wg=bCmQk&pd_rd_r=d73e5c94-5218-4b4e-8d25-2a86dfa45a6a&pd_rd_i=B00EZB1QQ2&psc=1&ref_=pd_bap_d_rp_21_t)

Tapered Plugs: [**9545K39**](https://www.mcmaster.com/9545K39)

[Plastic Wrap](https://www.amazon.com/Reynolds-912-Foodservice-Clear-Plastic/dp/B09246S98F/ref=sr_1_5?crid=34EPKJIRA4PQI&keywords=meat+and+deli+saran+wrap&qid=1663345560&sprefix=meat+and+deli+saran+wrap%2Caps%2C76&sr=8-5)

Unflavored gelatin: [Bulk Foods](https://bulkfoods.com/gelling-agents/unflavored-gelatin.html)

“Spacer” – ½” thick piece of plastic to place in the center compartment while the gelatin is setting. Cut to inner dimensions of tank (5.5x6.5”).

A picture containing sky

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Assembly:

1. Cut out 7x7” pieces of silicone (I find that using a craft knife and a ruler is easiest)

Punch holes in the corners using a boring tool. You can either use the “U”s as a guide or measure- holes are ¼” from each side.

1. Remove films from the silicone sheets. Cut a large piece of plastic wrap and apply slowly to the silicone sheet, smoothing out bubbles with your fingers. Cut an “X” in each hole with your craft knife so that the screws can pass through.
2. Add a thin layer of sealant to the center “U” and place the silicone sheet on top. Repeat for the other side, making sure that the silicone doesn’t sag too much. Add another layer of sealant on the other U’s and place them on top of the silicone.
3. Add more sealant and add the windows, tightening the nuts to snug torque. Hold the screws in place and tighten the nuts to avoid twisting your sheets around.
   1. You might find it easier to put the layers together in a different order. Apply silicone in a continuous bead to get the best seal.
4. Leave some time for the sealant to cure, then make the gelatin (Recipe: 28.35g gelatin/ 1L DI water). Boil the gelatin mixture in the microwave, then cool to room temperature.
5. Put spacers in the mud section to avoid the silicone deforming when the gelatin is added. Use aluminum foil to prevent the sheets from getting stuck to your spacer. Using a beaker, alternately pour the gelatin into the outer compartments. Cover with plastic wrap and refrigerate overnight.
6. Once the gelatin is set, use the silicone sealant to make a cap over the gelatin and fill the space between the silicone sheet and acrylic. Use a spatula to smooth it out and fill all air bubbles.
   1. You can also use a flexible, water impermeable rubber cut to size and fill all cracks with silicone.
7. Insert plugs into pressure sensor ports and fill the inner section with mud. Leave filled tanks to settle for at least 2-3 days.

Literature Cited:

Dorgan, K.M., Jumars, P.A., Johnson, B.D., and Boudreau, B.P. 2006. Macrofaunal burrowing: the medium is the message. *Oceanography and Marine Biology: An Annual Review* 44: 85-121.

Dorgan, K.M., Jumars, P.A., Johnson, B., Boudreau, B.P., and Landis, E. 2005. Burrow extension by crack propagation. *Nature* 433: 475.

Wethey, D.S., and Woodin, S.A. 2005. Infaunal hydraulics generate porewater pressure signals. *Biological Bulletin* 209: 139-145.