Version 1

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Assembly Instructions for colosseum V.1

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1 Works for me dx.doi.org/10.17504/protocols.io.btsennbe

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ABSTRACT

We present colosseum, a low-cost, modular, and automated fluid sampling device for scalable fluidic applications. The colosseum fraction collector uses a single motor, can be built for less than $100 using off-the-shelf and 3D-printed components, and can be assembled in less than an hour. Build Instructions and source files are available at https://github.com/pachterlab/colosseum.

DOI

dx.doi.org/10.17504/protocols.io.btsennbe

PROTOCOL CITATION

Sina Booeshaghi, Yeokyoung Kil, Kyung Hoi Min, Jase Gehring, Lior Pachter 2021. Assembly Instructions for colosseum. **protocols.io** https://dx.doi.org/10.17504/protocols.io.btsennbe

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GUIDELINES

Here are two YouTube videos on assembling colosseum:

General assembly with old version of tube rack:
https://youtu.be/yG7ECh5GO0o

New tube rack assembly:
https://youtu.be/50wahAvqyxM

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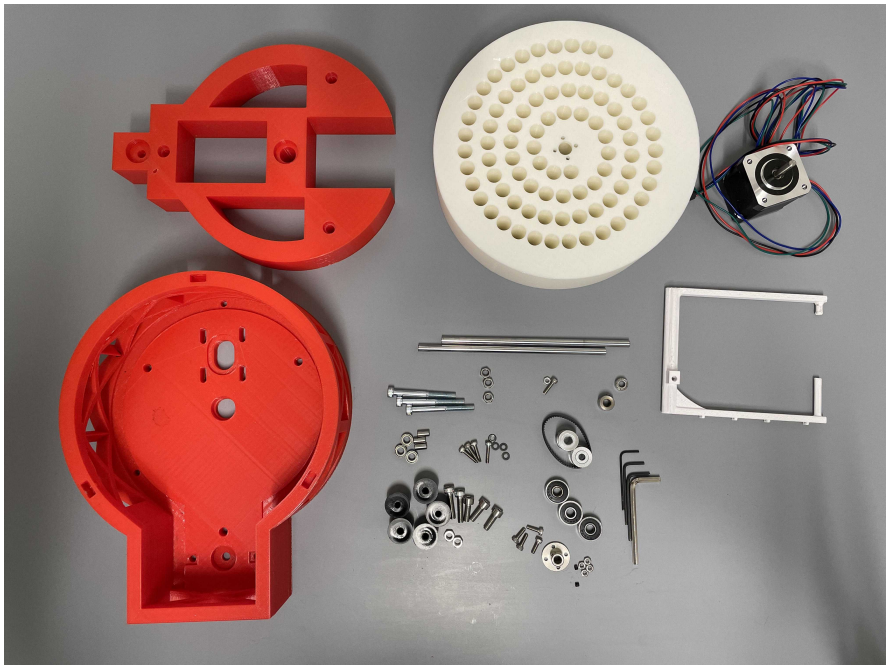
MATERIALS TEXT

Materials can be found in our bill of materials here or on our GitHub repository.

Preparation

1 Prepare 3D-printed components and parts.



Vendors and prices can be found in the bill of materials (https://docs.google.com/spreadsheets/d/1Z83jh0TSUGW6AqqXLzAsNthaGQMtfY0oZQ2VZEOLgi0/edit?usp=sharing)

Base and Base Plate Assembly

2 Assemble the base and motor.

2.1 Insert M5 screws into the narrower ends of the rubber feet. Two M5 screws should be 20 mm long, and the other three screws should be shorter (16 mm works fine).

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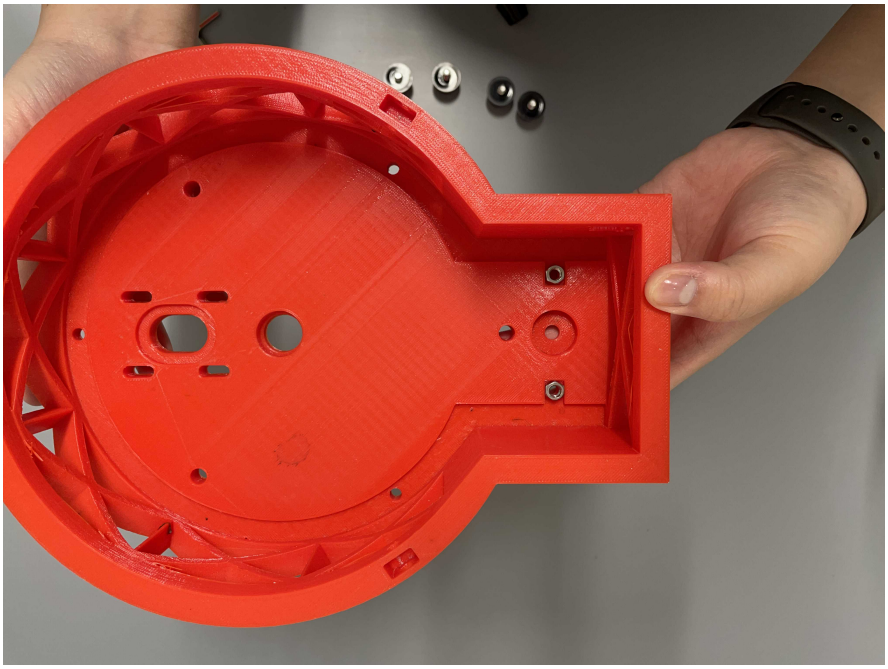
Insert the M5 screws.

2.2 Turn the base right side up and place two M5 hex nuts in the rectangular slots in the rectangular part of the base. The nuts should just sit in place and secure the rubber feet with the two longer M5 screws in place.



Place the M5 hex nuts on the bottom of the base.

2.3 Screw the rubber feet onto the bottom side of the base. The holes in the circular part of the base should get the rubber feet with the shorter M5 screws. Hold the M5 hex nuts in place as you screw in the two

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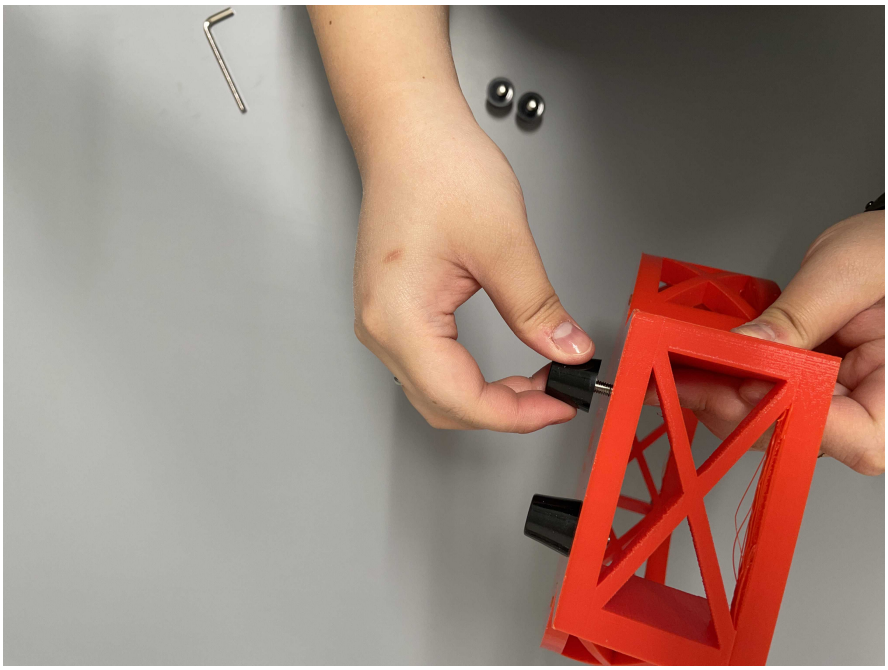
rubber feet with the 20 mm M5 screws.

Screw in the three rubber feet with the shorter M5 screws into the three holes of the circular part of the base.



Screw in the two remaining rubber feet with the 20 mm hex screws, holding the M5 hex nuts in place.

2.4 Place the motor upside down on the floor of the base, aligning the four holes of the motor with the four elliptical slits in the base. Pull the wires out through the openings on the wall of the base.

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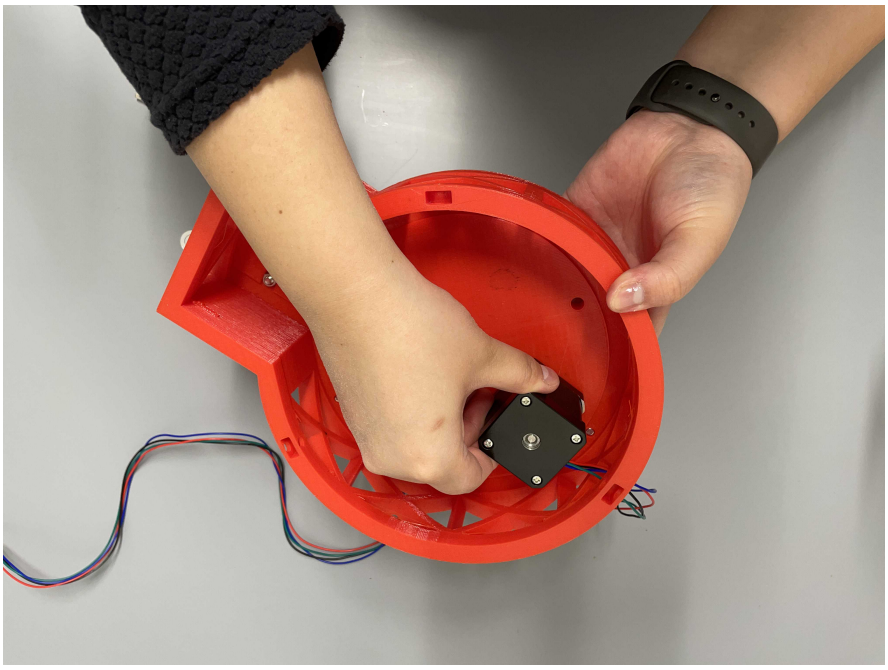
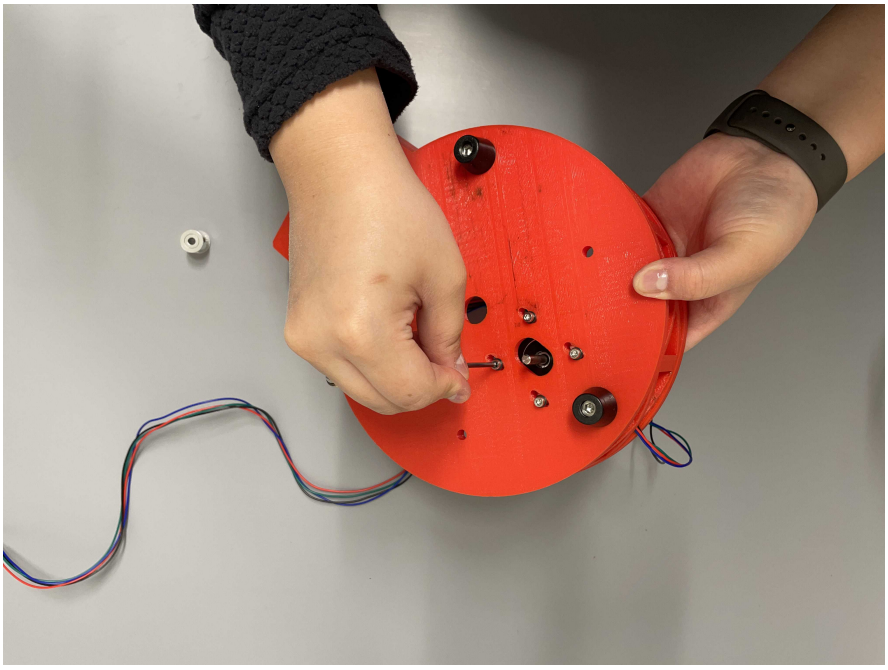


Place the motor on the floor of the base.

2.5 Loosely secure the motor in place with four M3 hex screws and washers. Make sure to place the washers between the plastic of the base and the head of the M3 hex screws so that the plastic does not get worn out. We will need to move the motor later so do not tighten the M3 screws all the way.



Loosely secure the motor in place.

2.6 Add the motor coupling pulley to the shaft of the motor. The side with the teeth should be facing towards the base. Secure it in place with the set screws.

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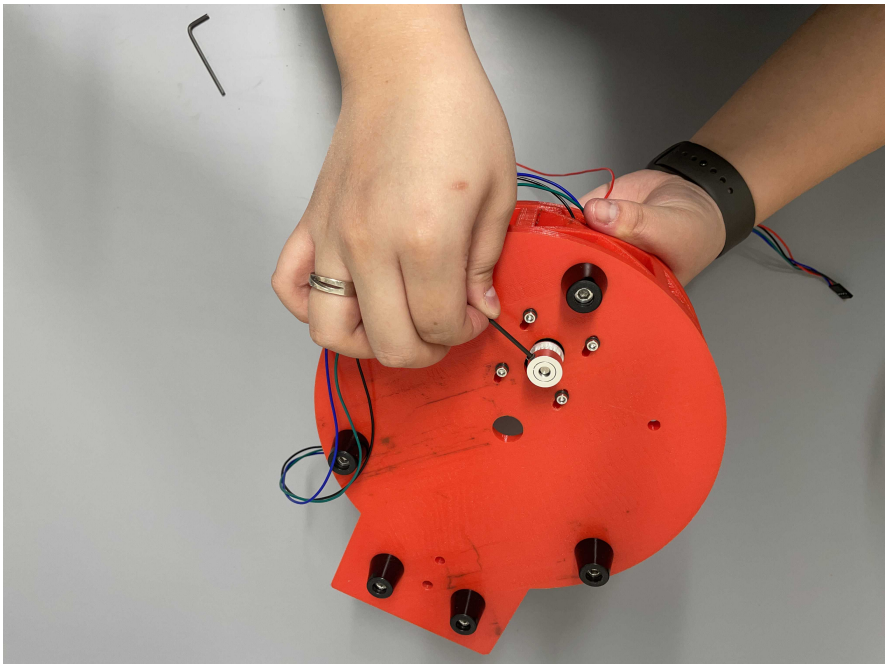
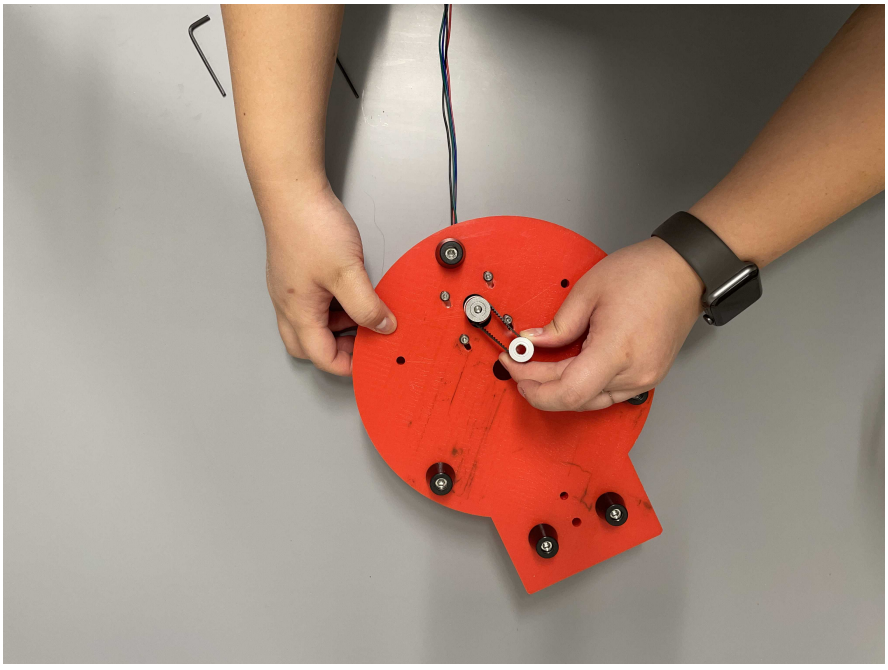


Add the motor coupling pulley to the shaft of the motor.

2.7 Take the 6 mm-bore coupling pulley and wrap the 120 mm pulley belt around both pulleys. Refer to the picture. Then, in the 6 mm-bore pulley, insert the shaft. Push the shaft all the way through the pulley so that the bottom of the shaft is flushed with the bottom of the pulley, and secure in place with set screws.



Wrap the 120 mm pulley belt around the two pulleys. The 6 mm-bore pulley fits the shaft and the 5 mm-bore pulley fits the motor. They are two different pulleys!

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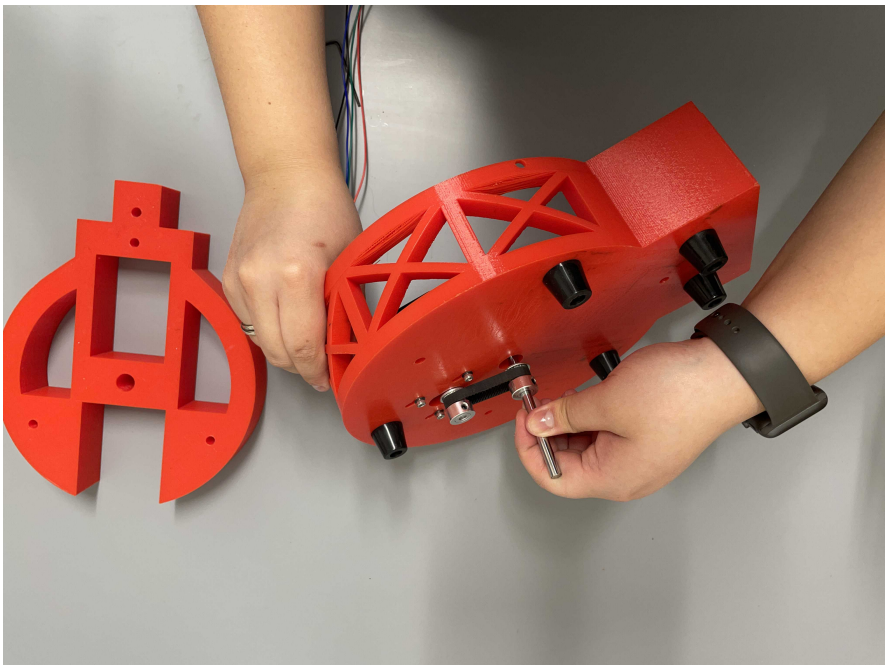
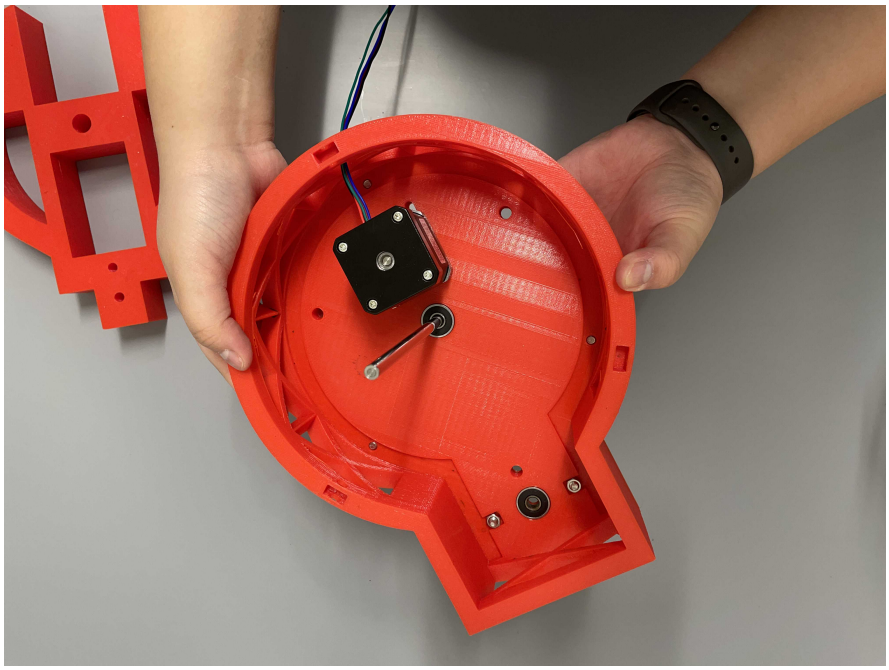


Insert the shaft into the 6 mm-bore pulley. Push all the way through until the bottom of the shaft is flushed with the bottom of the pulley and then secure in place with set screws.

3 Insert two bigger ball bearings into the circular slots on the floor of the base.



Insert two bigger ball bearings into the circular slots on the floor of the base. There is one in the center of the circular part of the base and another in the rectangular part of the base.

4 Insert the 3D-printed base plate into the base. Then, place two bigger ball bearings like you did for the floor of the base.

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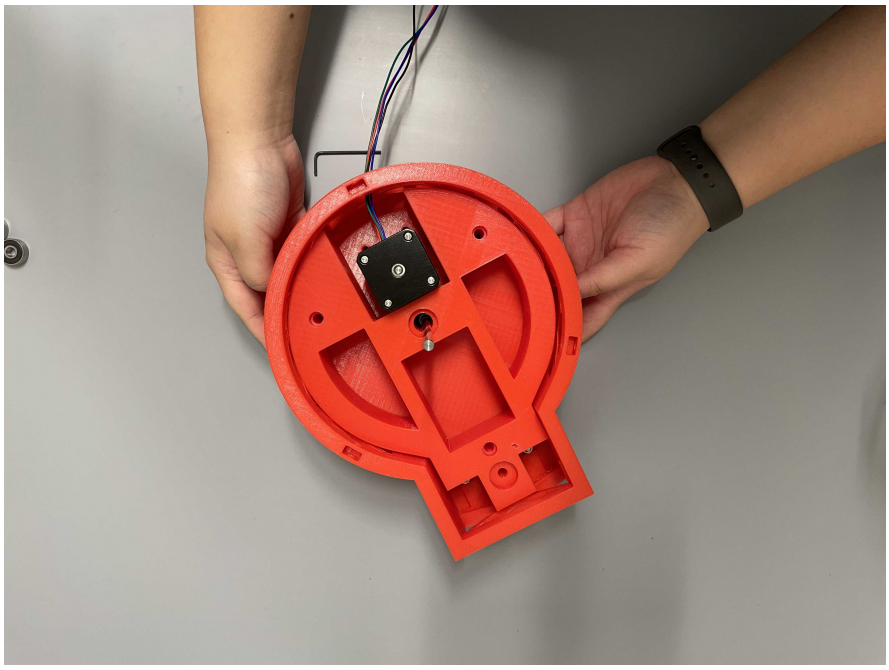
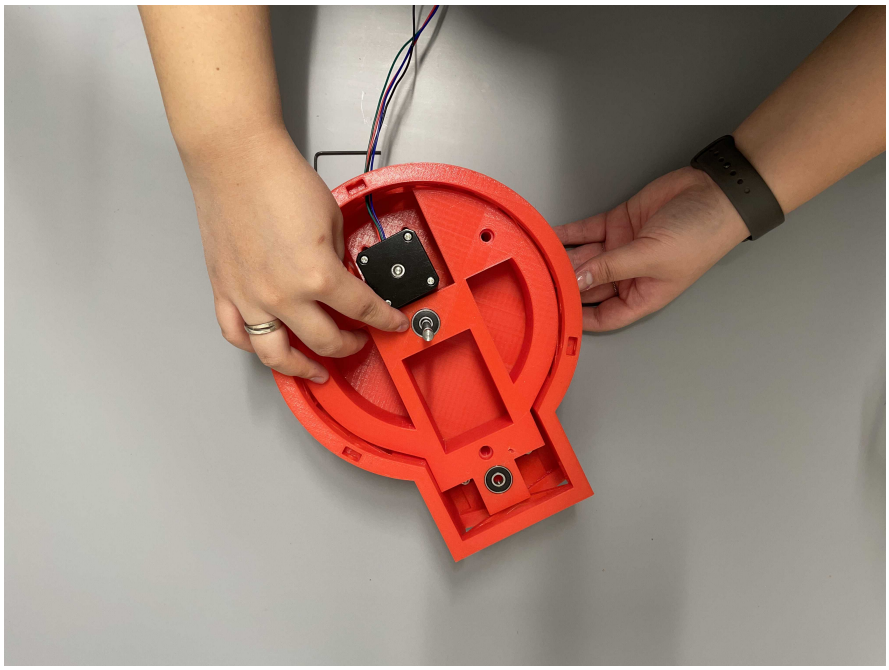


Insert the 3D-printed base plate into the base.



Insert two bigger ball bearings into the base plate.

5 Secure the base plate in place with three long M5 screws and hex nuts.

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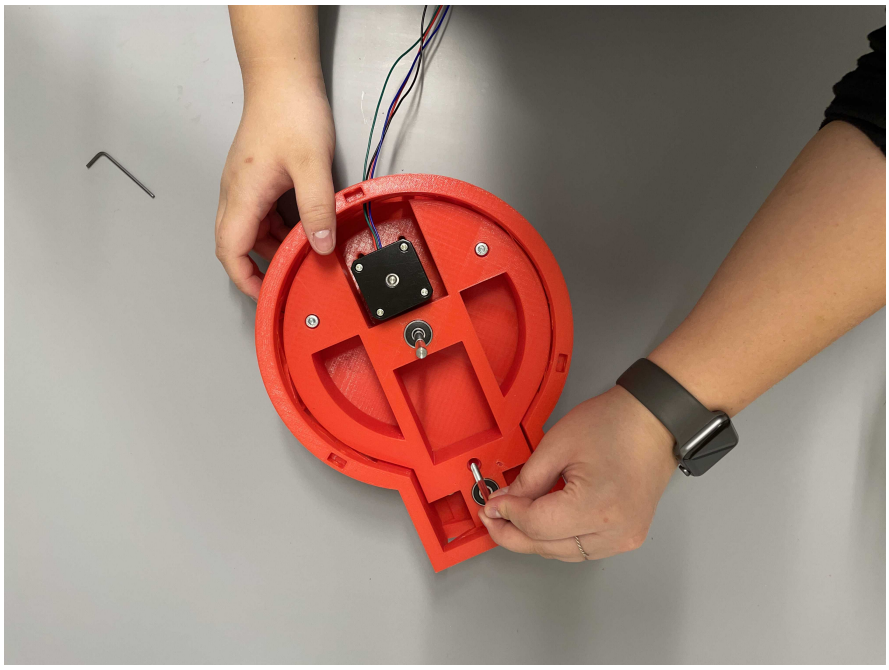
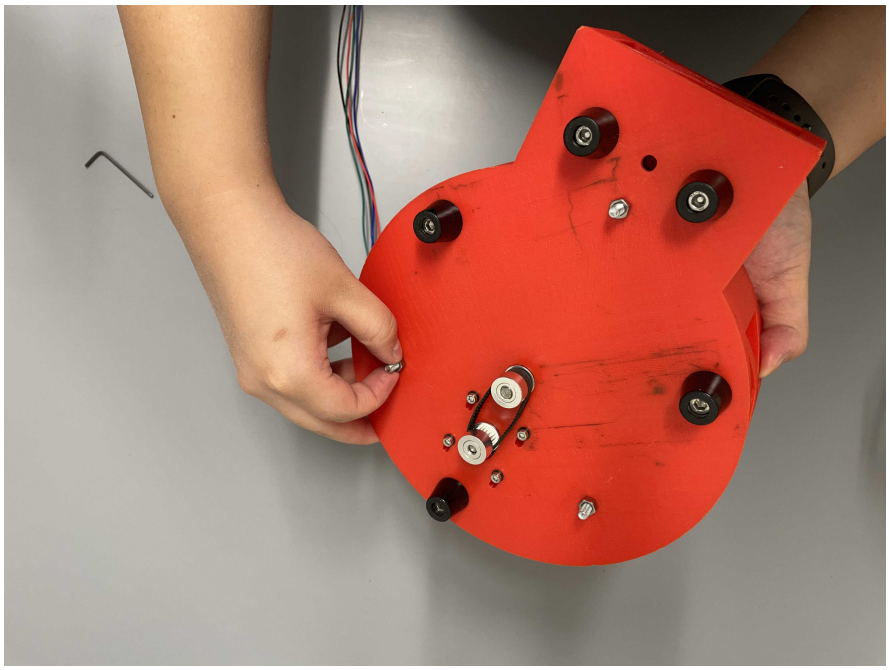


Insert the long M5 screws into the three holes of the base plate.



Tighten the M5 screws in place with hex nuts.

6 ⚠

Now, sliding the motor away from the shaft so that the pulley belt is taut, secure the motor tightly in place by tightening the four M3 screws.

IMPORTANT: Make sure you are not pulling too hard that the shaft is tilted.

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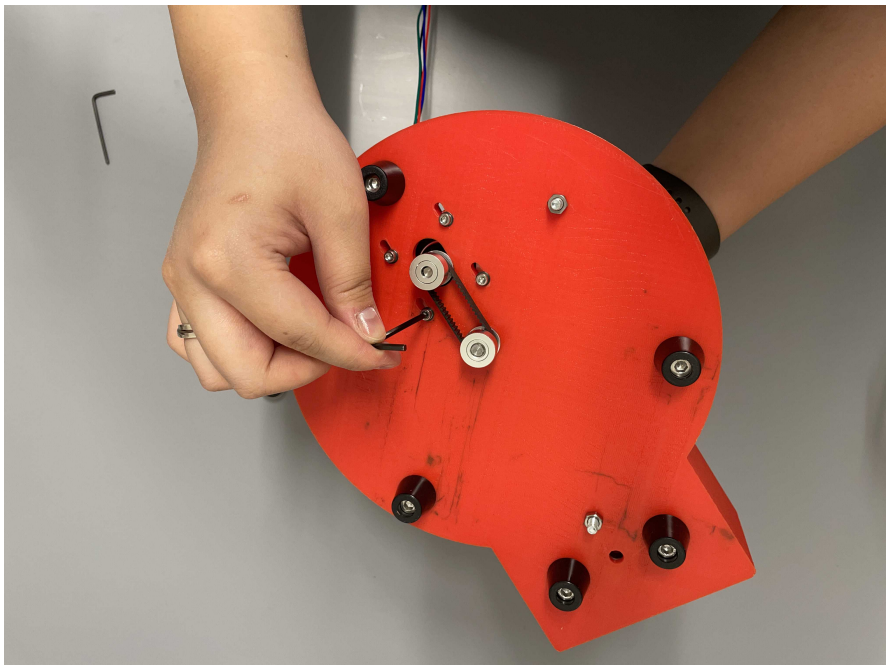
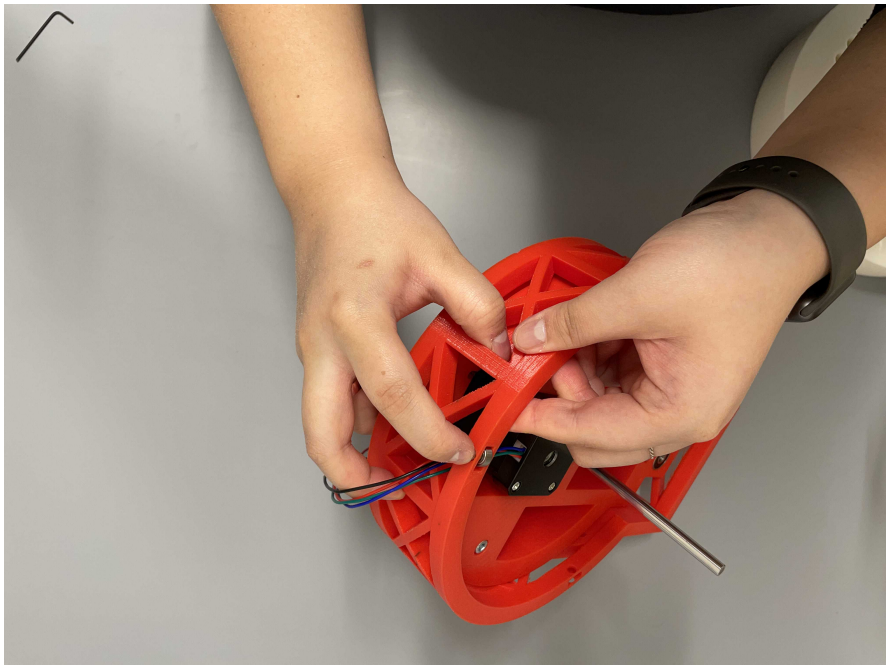


Slide the motor away from the rotary shaft so that the pulley belt is taut, but do not pull it too hard so that the shaft is tilted. Make sure to tighten the M3 screws to secure the motor in place.

7 Insert three small ball bearings into the rectangular slots on the top rim of the base. This is to ensure that the tube rack rotates with little friction. Secure the small ball bearings in place with M5 dowels.



Insert a small ball bearing into the rectangular slots on the rim of the base, and put a dowel through the circular hole of the base wall and also the center of the bearing.

The base and base plate are now finished!

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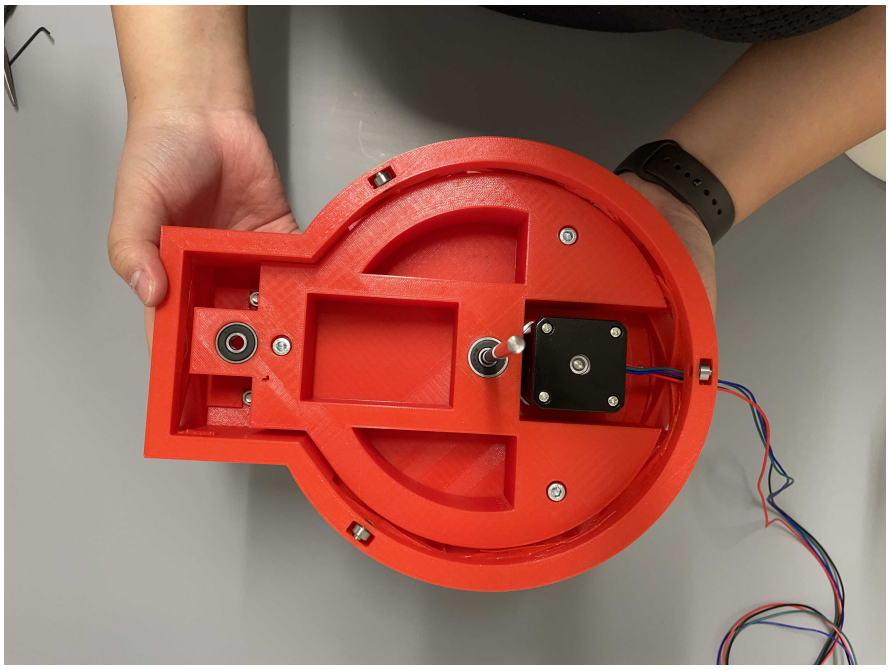
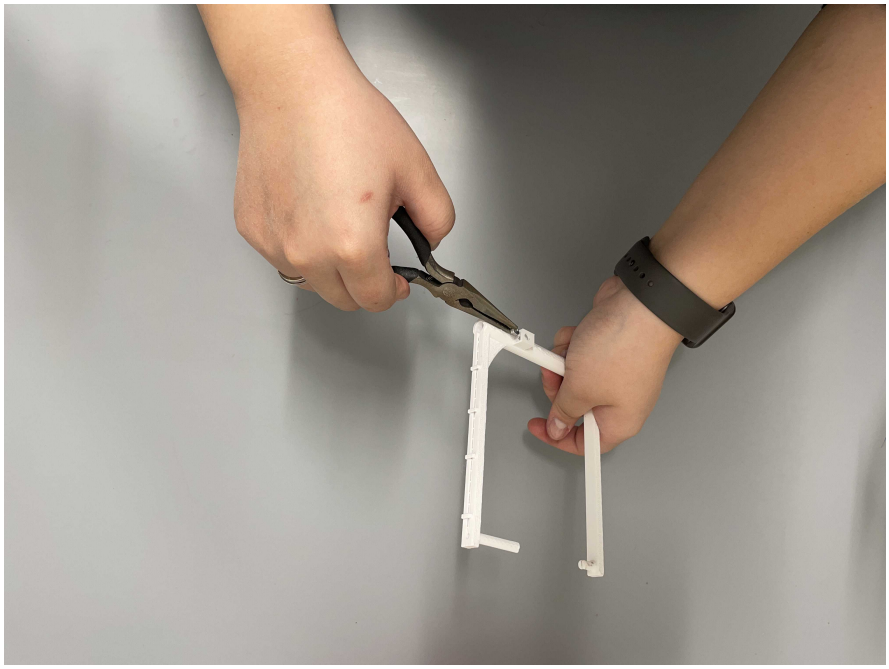


Arm Assembly 5m

8 Insert an M3 hex nut into the rectangular slot on the side of the arm. Then, screw an M3 hex screw into the circular hole that goes through the hex nut.



Insert an M3 hex nut into the rectangular slit on the side of the arm.

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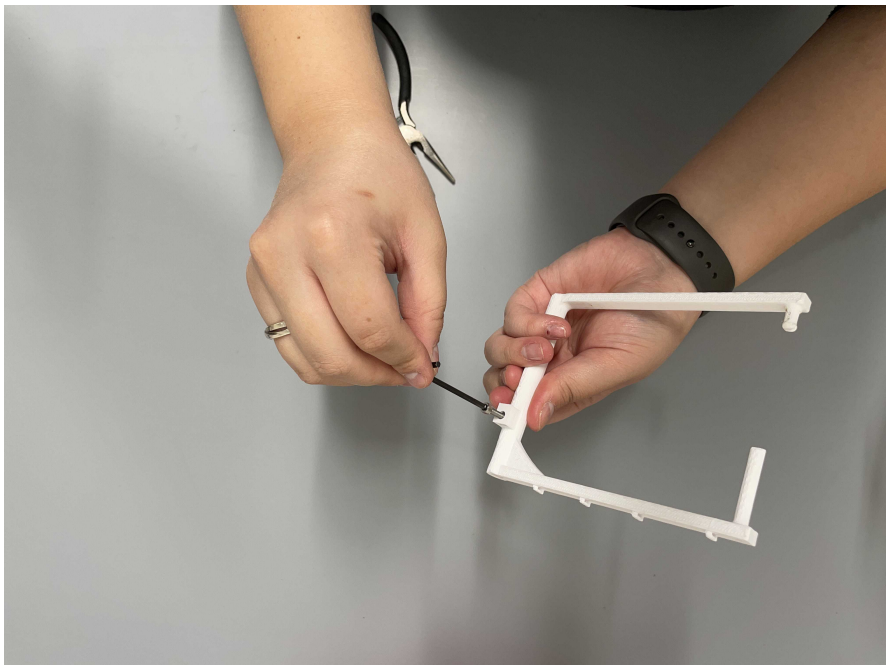
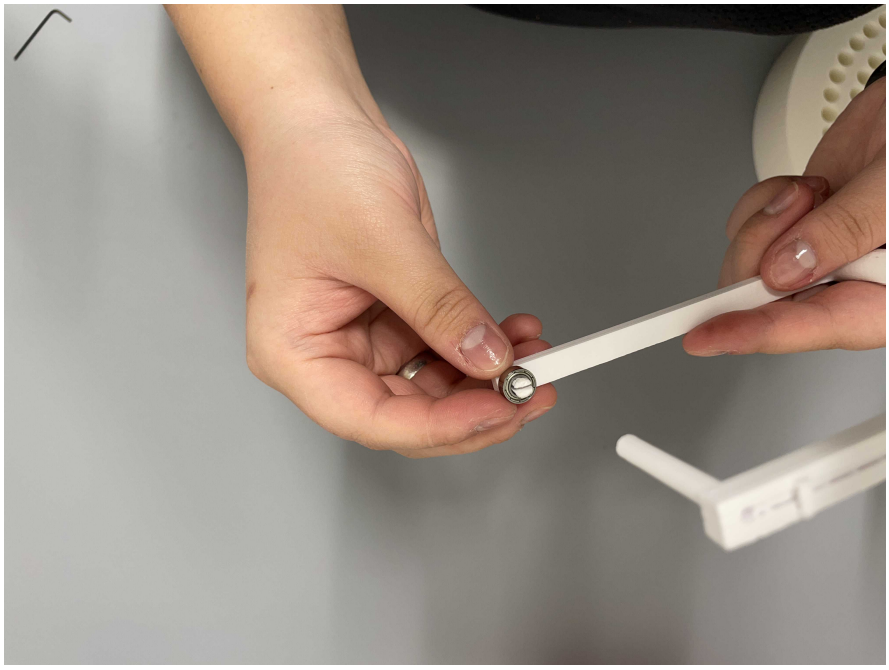


Screw an M3 screw through the circular hole and the M3 hex nut until it goes into the cylindrical part of the arm. Do not tighten this too much, as we will need to insert the rotary shaft later.

9 Push a small ball bearing through the little nib on the bottom arm. If the ball bearing does not go in, squeeze the nib with pliers. You may need to use some force on the bearing.



Put a small ball bearing on the nib of the arm.

10 Slide the rotary shaft into the arm and secure with the M3 set screw we inserted earlier. Then, add a shaft collar at the bottom of the arm so that it adds to the height of the arm.

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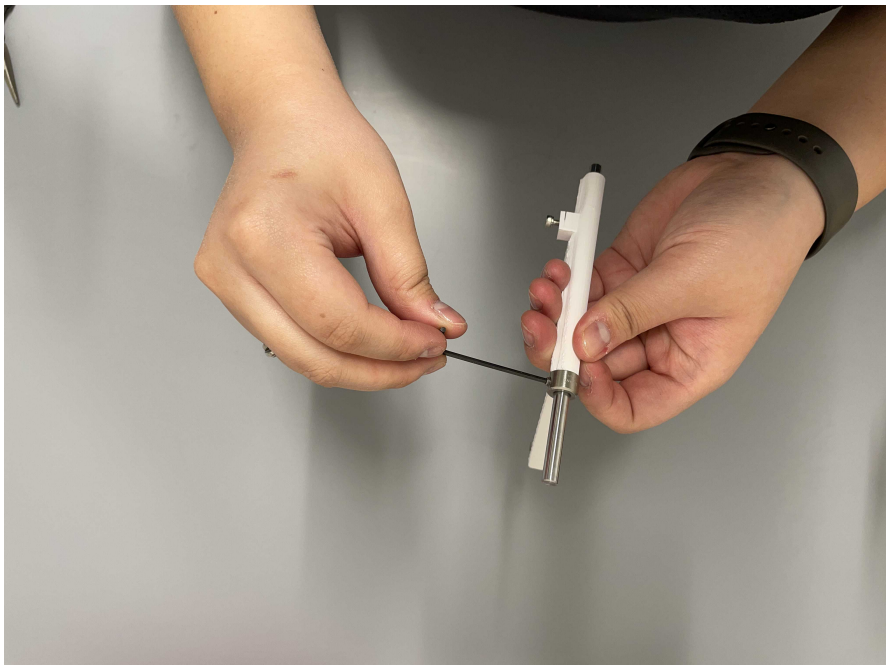
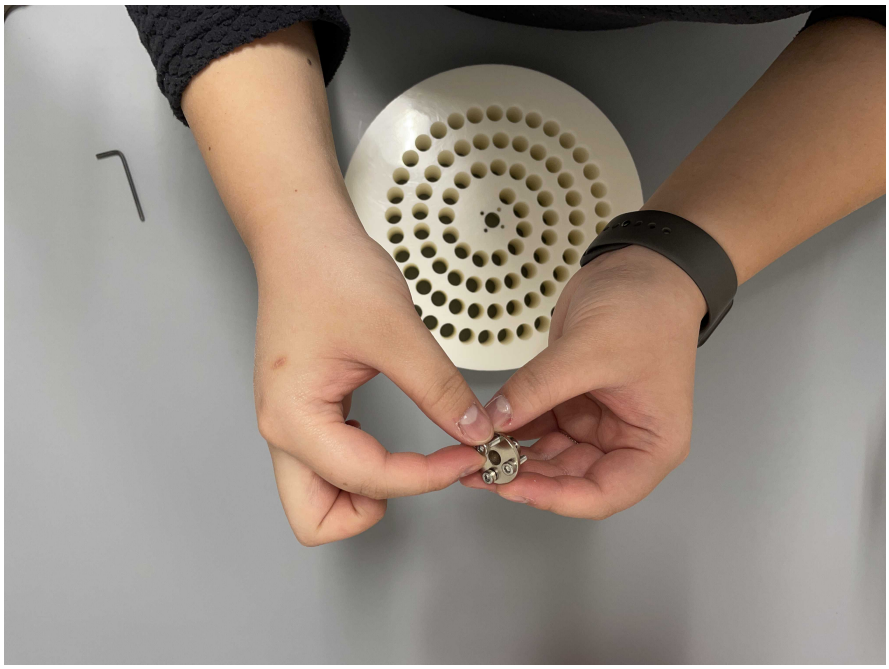


After tightening the shaft with the M3 hex screw, add a shaft collar at the bottom of the arm and tighten with set screw.

Arm assembly is complete!

Tube Rack Assembly 10m

11 Take the flange coupling and insert four M3 hex screws into the flat side of the coupling.



Insert four M3 screws into the flat side of the flange coupling.

12 Put the flange coupling into the cylindrical hole of the tube rack so that the protruded part of the flange coupling sticks out from the top of the tube rack. Screw the M3 hex screws all the way in.

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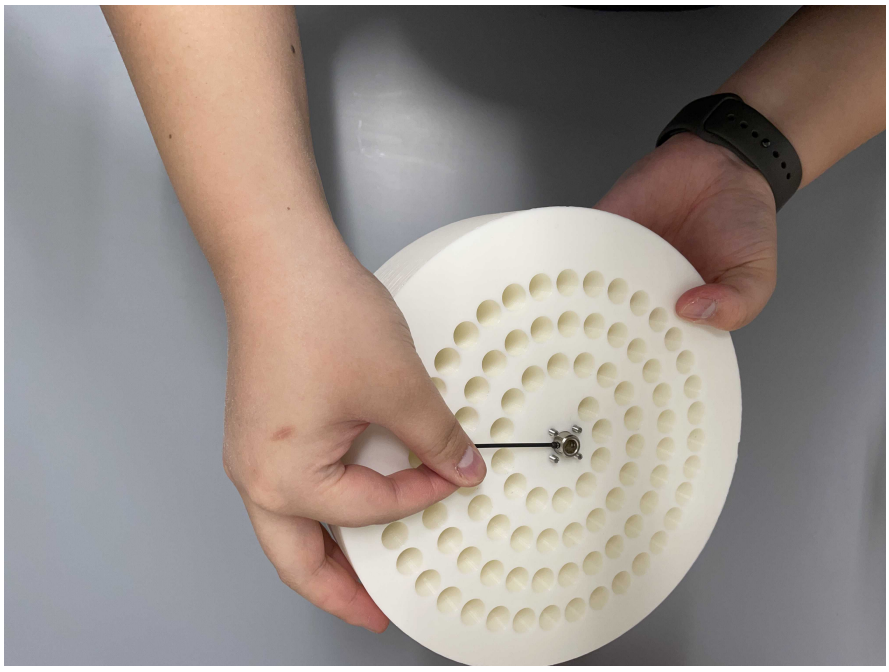
Attach the flange coupling to the tube rack.

13 Add the set screw on the flange coupling and set loosely in place.



Add the set screw on the flange coupling and set loosely in place.

14 Tighten the M3 screws in place with M3 hex nuts.

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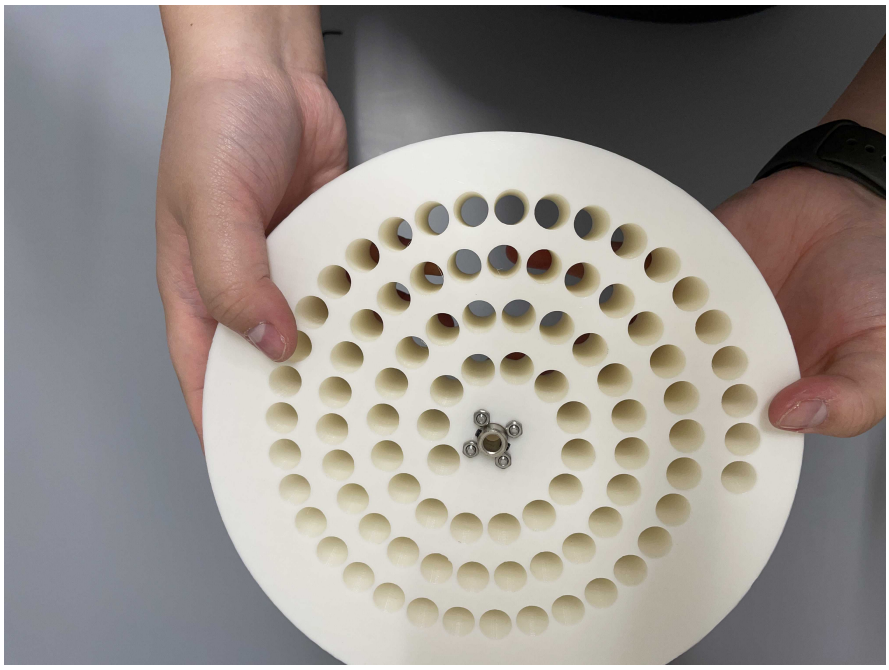
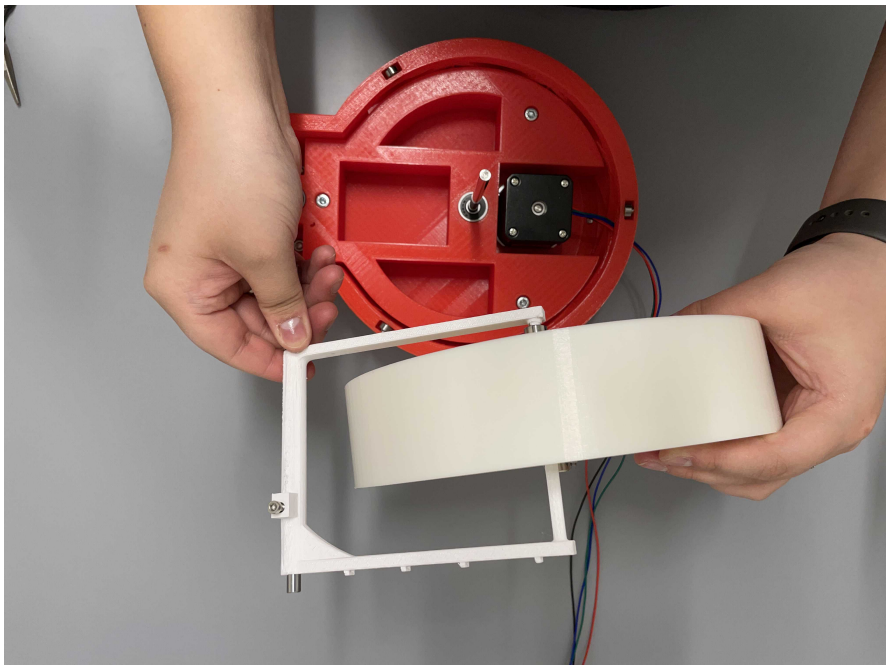


Tighten the M3 screws in place with M3 hex nuts.

Tube rack assembly is complete!

Complete Assembly 5m

15 Take the arm and tube rack and hold them as shown in the picture. This is the easiest way to put everything together.



Hold the tube rack and arm like this.

Then, put the parts together by inserting the base rotary shaft into the tube rack and putting the arm rotary shaft through the ball bearing in the rectangular part of the base.

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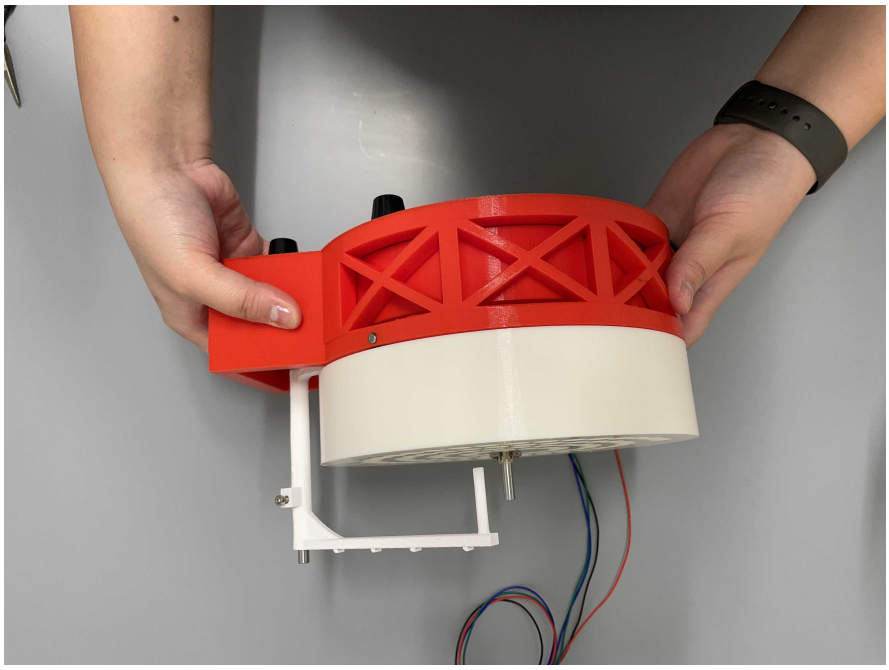
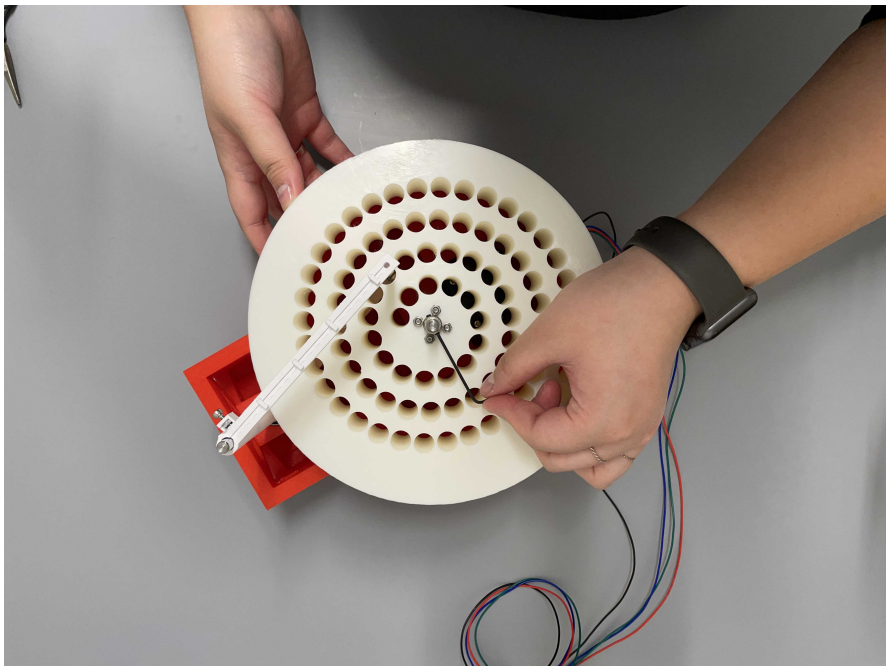


Put the parts together!

16 Finally, tighten the set screws on the flange coupling and we are done assembling colosseum.



Tighten the set screws on the flange coupling.

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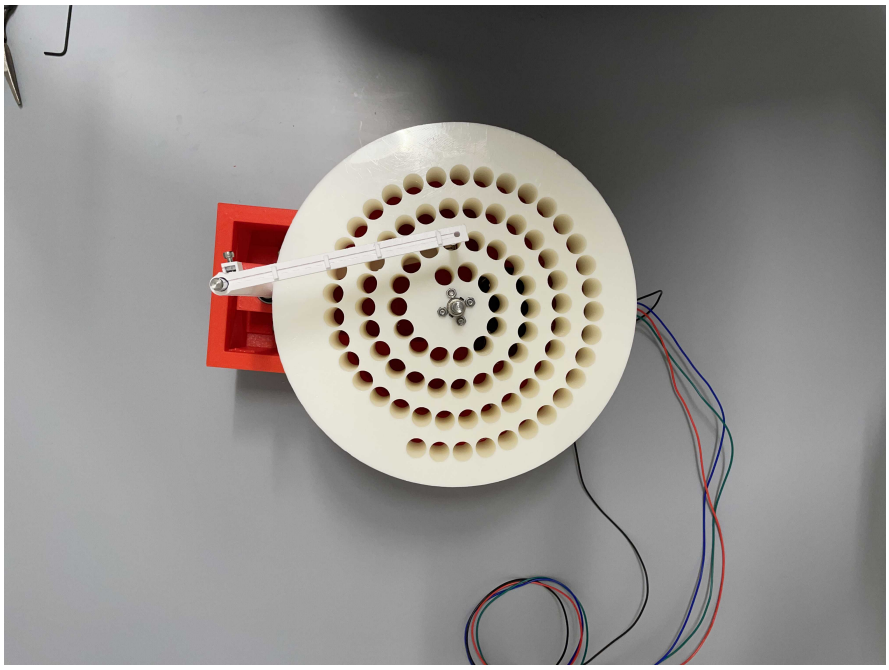

Assembly complete!

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