

# Mini Extruder Pro

Your guide to confident extrusion workflows

**Setup. Technique. Care. Support.**



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# The Avanti Research™ Mini Extruder Pro

## Before you begin Set up for successful extrusion

The Mini Extruder Pro is designed to support controlled, reproducible liposome preparation workflows. Before starting, take a moment to confirm your materials, temperature requirements, and consumables are ready. Proper setup can help reduce back pressure, leaks, and inconsistent particle sizing during extrusion. A few quick checks upfront can make the workflow smoother, more efficient, and easier to troubleshoot if adjustments are needed.

### Your extrusion checklist

- ✓ Clean components are dry and ready
- ✓ Correct membrane pore size selected
- ✓ Fresh membranes and filter supports available
- ✓ Buffer and lipid suspension prepared
- ✓ Heating block set to the required temperature
- ✓ Syringes inspected and functioning properly

### Quick prep tips



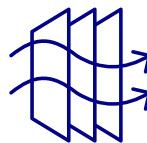
#### Prepare your workspace

Gather the extruder, syringes, membranes, buffer, sample vial, and heating block before beginning.



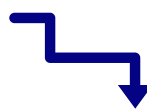
#### Confirm formulation needs

Match membrane pore size and extrusion temperature to your formulation.



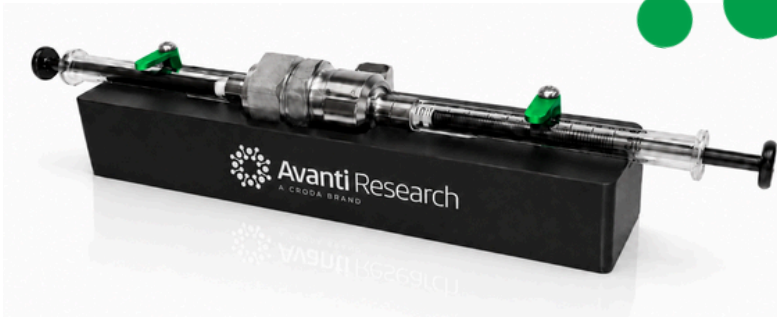
#### Use fresh consumables

Polycarbonate membranes and filter supports are intended for single use.



#### Plan your extrusion path

For difficult samples, consider starting with a larger pore size and stepping down.



### Why this matters

Good preparation can help reduce leaks, back pressure, and inconsistent particle sizing.

## Convenient

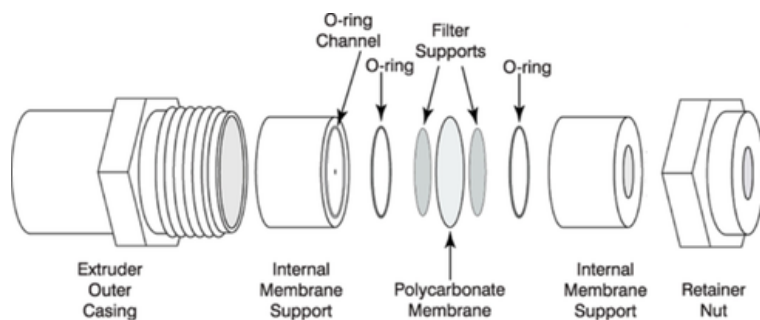
- Quickly prepare unilamellar vesicles through a simple extrusion process
- Easy to assemble, operate, and clean
- All wetted parts can be cleaned rapidly, minimizing downtime between lipid formulations
- Produces uniform vesicles without solvents or detergents
- Vesicle size is easily controlled by selecting the appropriate polycarbonate membrane

## Flexible

- Can be placed directly on a hot plate for rapid temperature control
- Base acts as a heating block allowing for extrusion at elevated temperatures. Ideal for lipids with phase transition temperatures above room temperature
- Capable of producing unilamellar liposomes ranging from ~30 nm to 5 µm, depending on membrane selection
- Compatible with a wide variety of lipid compositions

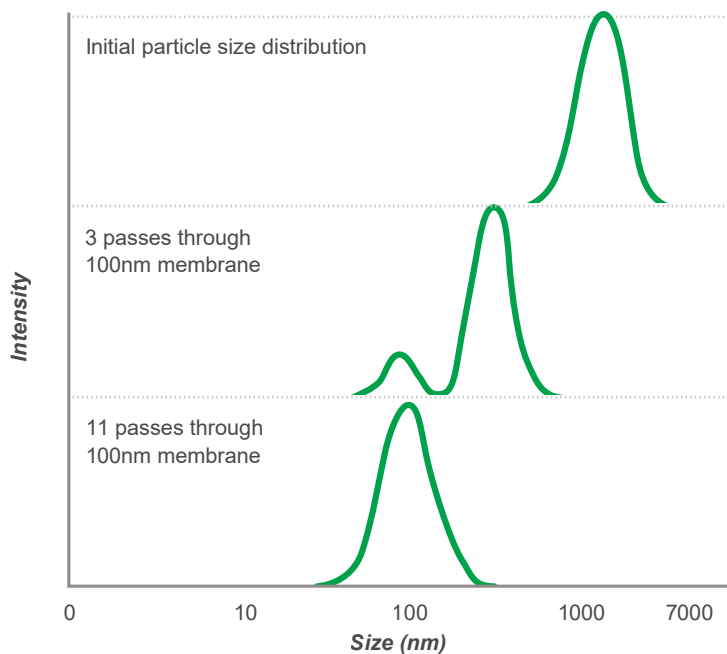
## Affordable

- Constructed from durable stainless steel and PTFE for long-term, trouble-free use
- Available at a fraction of the cost of alternative options
- Replacement parts are readily available from Avanti Research™
- Complete set includes:
  - Mini Extruder Pro body
    - Stainless steel extruder outer casing
    - PTFE Internal Membrane Support (2)
    - O-ring (2)
    - Stainless steel Retainer Nut
  - Base
  - 2 gas-tight 1mL syringes
  - 100 0.1µm polycarbonate membranes
  - 100 filter supports

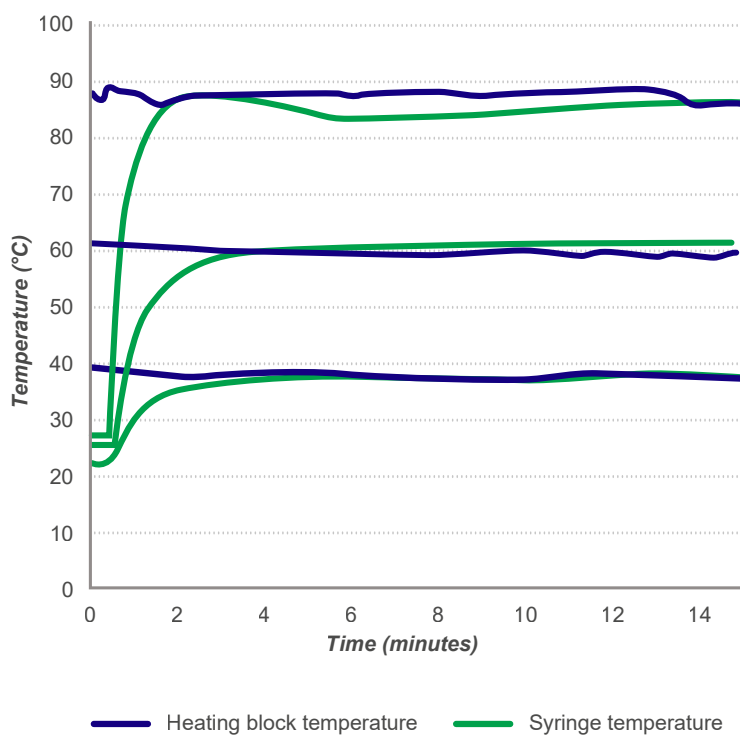


## Reliable performance

- Vesicle size distribution depends on the number of passes through the membrane
- Hydrated lipids initially form large, multilamellar vesicles
- With repeated extrusion: Early passes yield a broad or bimodal size distribution
- Additional passes yield a narrow, uniform particle size distribution
- At least 11 passes through the membrane are recommended for most lipid systems



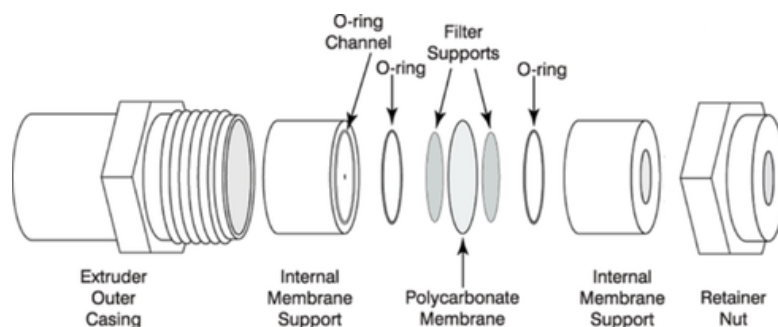
Placing the base assembly on a hot plate achieves rapid temperature control for lipids that have transition temperatures above room temperature.



# Mini Extruder Pro

## Assembly Guide

### Components at a glance



### Before you begin

Clean all parts before first assembly, except polycarbonate membranes and filter supports. Use mild detergent, rinse with hot water and DI or distilled water, and allow parts to dry completely.

### Start assembly

#### 1 Prepare supports

Place the two internal membrane supports on a flat surface with the O-rings facing up.



#### 2 Wet filters

Pre-wet a filter support with DI water, or buffer, and center inside the O-ring. The filter support should adhere to the PTFE orifice inside the O-ring inner diameter.



#### 3 Insert first PTFE support

Insert the internal membrane support, with the filter support, into the extruder outer casing with the O-ring facing up.



#### 4 Add membrane

Place one thin, shiny polycarbonate membrane over the filter support and O-ring.\*



\*Do not install the blue separator paper.

# Finish assembly

## Final steps, cleaning, and handling notes



### 5 Wet second filter support

Pre-wet a second filter support with DI water, or buffer, and place over orifice of remaining internal membrane support.



### 6 Insert second PTFE support

Carefully place the second internal membrane support into the casing (O-ring facing down) being careful not to twist the membrane support when it comes in contact with the membrane. It is best to lift the internal membrane support up inside the stainless steel outer casing to prevent movement of the polycarbonate membrane due to creation of vacuum.



### 7 Tighten retainer nut

Place the retainer nut on the threaded end of the extruder outer casing and tighten. Tighten the retainer nut by hand just until it is finger tight; do not use a wrench.



### Important notes

- Polycarbonate membranes and filter supports are single-use only.
- Autoclaving the Mini-Extruder Pro and syringes is not recommended because slight distortion may occur.
- Ethylene oxide or gamma irradiation may be used as alternatives.
- Sterilize syringes with ethanol.

### Clean after each batch

- Disassemble and clean after each extrusion batch.
- Rinse the Mini-Extruder Pro with methanol or acetone to dry.
- For first-time use, clean all reusable parts with mild detergent and rinse with hot water and DI or distilled water.

### Warranty

Avanti Polar Lipids, LLC guarantees the apparatus free of defects of workmanship for a period of thirty (30) days. If you experience any problems due to workmanship during this time, please contact us to arrange an immediate replacement or exchange of the defective component.

For more resources and information, scan here!



# Mini Extruder Pro

## Extrusion technique guide

A quick-reference workflow for preparing liposomal suspensions with confidence.



### Membrane selection matters

Extrusion of multilamellar liposomal suspensions using membranes with a pore size  $>0.2\mu\text{m}$  does not produce unilamellar liposomes. Liposomes produced with larger pore membranes will yield a polydispersed suspension of multilamellar liposomes. Unilamellar liposomal suspensions with a low polydispersity can only be prepared with membranes having a pore size of  $\leq 0.2\mu\text{m}$ .

### Pre-wet first

Pass a syringe full of buffer through the extruder, then discard the buffer

### Single use

Polycarbonate membranes and filter supports are for one liposome preparation only.

### 80°C max

Do not exceed 80°C; higher temperatures can damage the extruder and syringe components.

## Setup workflow

### 1 Prepare dry lipid mixture

Prepare by lyophilization or evaporation

### 2 Heat the base

Place base on hot plate and allow block to reach temperature (~15 min).

### 3 Hydrate sample

Hydrate at least 30 mins above phase transition temperature.



### 4 Load and dock syringes

Once hydrated, load sample into one gas-tight syringe and dock into one side of the Mini Extruder Pro.

Set the empty syringe plunger to zero and dock it on the opposite side.



### Do not twist syringes

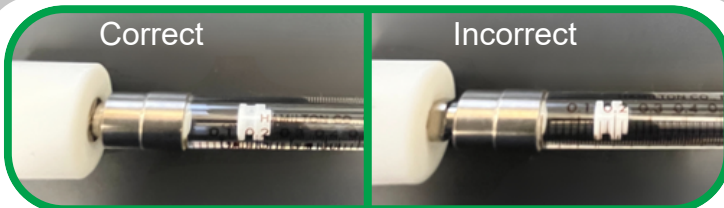
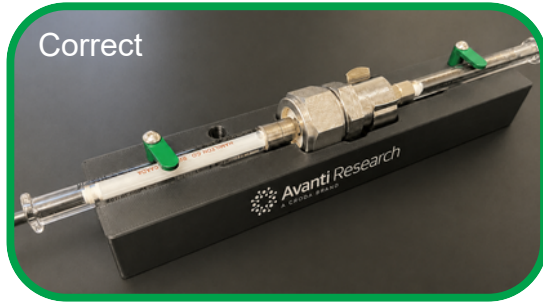
Slide into body until firmly seated. Twisting can loosen needles and create leaks.

# Run the extrusion

Use gentle, controlled transfers and keep the system seated correctly throughout the workflow.

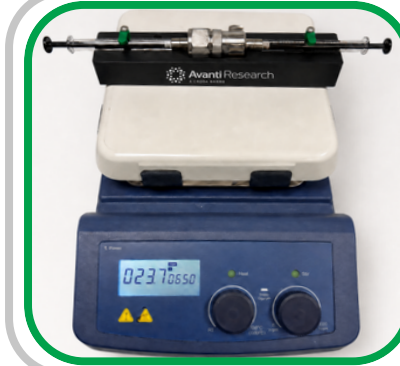
## 1. Setup + thermal contact

Seat the extruder apparatus into the base and then insert the syringes. Use the swing arm clips to keep the syringes aligned and in good thermal contact.



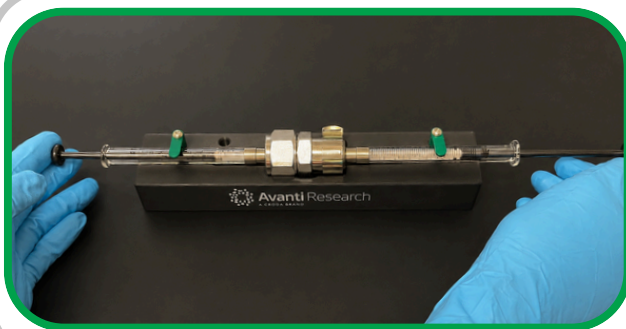
## 2. Seat syringes correctly

Do not twist; syringes should fit tight into the extruder.



## 3. Equilibrate temperature

Allow suspension to equilibrate for approximately 5-10 minutes.



## 4. Transfer back and forth

Gently push the filled syringe to transfer the lipid solution to the alternate syringe, then transfer it back.

**Minimum 11 passes**

More passes improve homogeneity.



## 5. Collect from the alternate syringe

Collect final extrusion from the alternate syringe. Remove the unit from the heating block, then pull syringes straight out by sliding on the base. Use care: solution and syringe may be hot.

Scan here for full technique guide:



# Mini Extruder Pro

## FAQs

Common questions on compatibility, preparation, cleaning, troubleshooting, storage, and support.

### FAQs at a glance

#### New connection

Gas-tight luer-lock syringes



#### Single-use

Membranes and supports



#### Size guidance

Approx. 10% above pore size



#### Typical passes

≥11 passes

11

#### Storage of liposomes

2-8 °C; avoid freezing



#### Warranty

30 days for workmanship defects



### Questions covered

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What's new?

Mini Extruder Pro overview

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Compatibility with original

Mini Extruder parts

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Membranes, supports, and  
expected particle size

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Sample preparation and  
extrusion best practices

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Warranty, availability,  
and related resources



# 1

## What's new?

An overview of the Mini Extruder Pro

### What is new about the Mini Extruder Pro?

An updated version of our original Mini Extruder, designed to improve user experience while maintaining the familiar extrusion workflow. It uses new gas-tight luer-lock syringes, plus a redesigned base and internal PTFE membrane support.

### How is it different from the original Mini Extruder?

The main differences are the syringe connection, internal support geometry, and holder/base design. The new design eliminates the PTFE Seal (610035) and PTFE Extruder Washer (610019), simplifying the system.

### Are the new luer-lock syringes gas-tight?

Yes. The Mini Extruder Pro luer-lock syringes are gas-tight and are intended to improve handling and help reduce common leaking issues at syringe connection points.

### What temperature can the syringes tolerate?

The syringes have been tested for use up to 80°C, the same maximum use temperature as the original Mini Extruder syringes.

# 2

## Compatibility

Use only parts designed for the updated system

### Can I use Mini Extruder Pro syringes with the original Mini Extruder?

No. The luer-lock syringe hub is too large to fit into the internal PTFE membrane support of the original Mini Extruder.

### Can I use the original screw-cap syringe needle with the new luer-lock syringe?

No. The original screw-cap syringe needle is not compatible with the Mini Extruder Pro luer-lock syringe.

### Can I use my original holder/base with the Mini Extruder Pro?

No. The Mini Extruder Pro must be used with the base designed for the updated system.

### Will replacement parts for the original Mini Extruder still be available?

Replacement parts for the original Mini Extruder are expected to remain available until December 2026.

### Will the original Mini Extruder still be available for purchase?

The original Mini Extruder will be removed from the Avanti Research™ website when the Mini Extruder Pro becomes available.

## Membranes and sizing

Consumables, pore size, and expected particle size



### Can I reuse membranes or polyester membrane supports?

No. Membranes and polyester membrane supports are single-use consumables. Use them for one preparation, then discard before starting a new batch.

### What membranes are compatible?

Use circular membranes that are 19 mm in diameter. Avanti Research recommends choosing membrane material and pore size based on formulation and application; function is guaranteed only with membranes supplied by Avanti Research™.

### What particle size should I expect from a membrane pore size?

Extruded particle size is usually close to, but not identical to, the membrane pore size. As a guideline, final particle size may be approximately 10% higher than the stated pore size. For example, a 0.1  $\mu\text{m}$  membrane may produce particles around 110-120 nm under suitable conditions.

### How many passes are usually needed?

Approximately 11 passes are commonly used, although the optimal number may vary by formulation and target size distribution. Always complete extrusion with an odd number of passes.

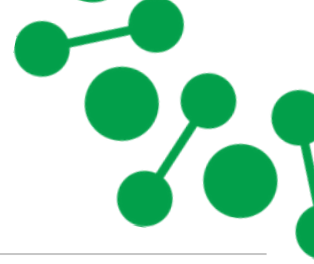
### Particle size reminder

Final particle size depends on formulation composition, starting particle size, extrusion temperature, number of passes, membrane pore size, and sample preparation.

Confirm size distribution with DLS or another suitable method.

## Sample preparation

Reduce back pressure and support consistent extrusion



### How should I choose a membrane pore size?

Avoid starting with a pore size that is too small for the starting particle size. A step-down approach is recommended: begin with a larger pore size, then move to smaller pore sizes until the target size is reached.

### Should I sonicate before extrusion?

Sonication can help reduce starting particle size and make extrusion easier, especially for large or heterogeneous particles after hydration. A common approach is to sonicate first, then step down gradually in membrane pore size.

### Does my lipid formulation need to be heated?

Some formulations must be heated. Lipid suspensions should be maintained above the formulation transition temperature during extrusion. If below transition temperature, back pressure, leaking, poor transfer, or membrane rupture may occur. If the formulation transition temperature is unknown, use the highest transition temperature among its individual lipid components.

### Can the Mini Extruder Pro prepare LNPs containing nucleic acids?

It is not designed for encapsulating nucleic acids into lipid nanoparticles. For nucleic acid-containing LNPs, solvent injection methods, especially microfluidic mixing, are commonly used.

### Does Avanti Research™ provide formulation protocols?

Avanti Research™ does not provide proprietary preparation protocols for specific customer formulations. Customers may consult scientific literature for approaches such as thin-film hydration, solvent injection, or microfluidic methods.

#### Suggested step-down example

0.7  $\mu\text{m}$  -> 0.4  $\mu\text{m}$  -> 0.2  $\mu\text{m}$  or 0.1  $\mu\text{m}$ , depending on the target size and formulation behavior.



### **My extruder is leaking. What should I check first?**

Identify where the leak is coming from. Check syringe wear, assembly, back pressure, membrane clogging, and whether the formulation is above its transition temperature. Confirm membrane, supports, and syringes are properly seated.

### **Why is there back pressure during extrusion?**

Some back pressure is expected. Excessive back pressure may mean the particles are too large for the membrane pore size or the formulation is not heated appropriately. Sonicate, use a larger pore size, and confirm temperature.

### **The syringes are very hard to push. What should I do?**

Measure particle size if possible and choose an appropriate membrane pore size. If particle size cannot be confirmed, sonicate for at least 30 minutes, start with a 0.7  $\mu\text{m}$  membrane, then step down.

### **My syringe is not drawing up fluid. What should I check?**

Inspect the barrel, plunger, and luer-lock connection for wear, damage, residue, or blockage. If it does not draw or dispense after cleaning and inspection, replacement may be needed. Attempt to draw up and dispense liquid with and without the needle attached to determine if the needle or syringe is causing the issue

### **Liquid is leaking from the back of my syringe. Why?**

This usually indicates that the plunger tip is worn. Replacing the plunger may resolve the issue.

### **What if a syringe needle or connector becomes stuck?**

Stop using the device and carefully remove the part using appropriate tools and laboratory safety precautions. Damaged or deformed parts should not be reused.

### **Troubleshooting sequence**

Check assembly first. Then check temperature, membrane pore size, starting particle size, clogging, and syringe condition.



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## Cleaning and care

Before first use, after every batch, and before reuse after storage

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### How should I clean the Mini Extruder Pro?

Clean before first use, after every batch, and again before use if stored for an extended period. A mild laboratory-appropriate detergent followed by thorough rinsing with copious DI water is generally suitable.

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### How often should I clean the syringes and extruder?

Clean upon receipt and subsequently before and after each use. Regular cleaning helps reduce residue buildup and supports consistent extrusion performance.

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### Can the Mini Extruder Pro be autoclaved?

Body components can tolerate autoclaving, but PTFE can become more malleable under extreme temperatures and warranty does not extend to damage caused by autoclaving. Do not autoclave the syringes.

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## Storage and handling

After liposome preparation

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### At what temperature should I store liposomal suspension?

Prepared liposomal suspensions are most stable when refrigerated at 2-8 °C. Do not freeze unless the formulation has been specifically validated for freeze/thaw storage.

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### What buffer conditions are recommended?

Neutral pH buffers are recommended. Storage outside the neutral pH range can reduce stability. Optimal buffer conditions depend on composition and intended application.

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## Warranty and resources

Support for the updated system

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### Does the Mini Extruder Pro come with a warranty?

Yes. Avanti Polar Lipids, LLC guarantees the product is free of workmanship defects for 30 days. If a workmanship-related issue occurs during this period, contact us for replacement or exchange support.

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### Can I test the Mini Extruder Pro before purchasing?

Avanti Research™ does not offer demos for this product.

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### Where can I find additional guidance?

Refer to Avanti Research's Mini Extruder assembly, extrusion technique, care, syringe cleaning, and replacement part resources. Instructional videos and product support pages may be linked from the website.

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