



Breathe Brick | Yuxin_Xiujin_Zhijuan

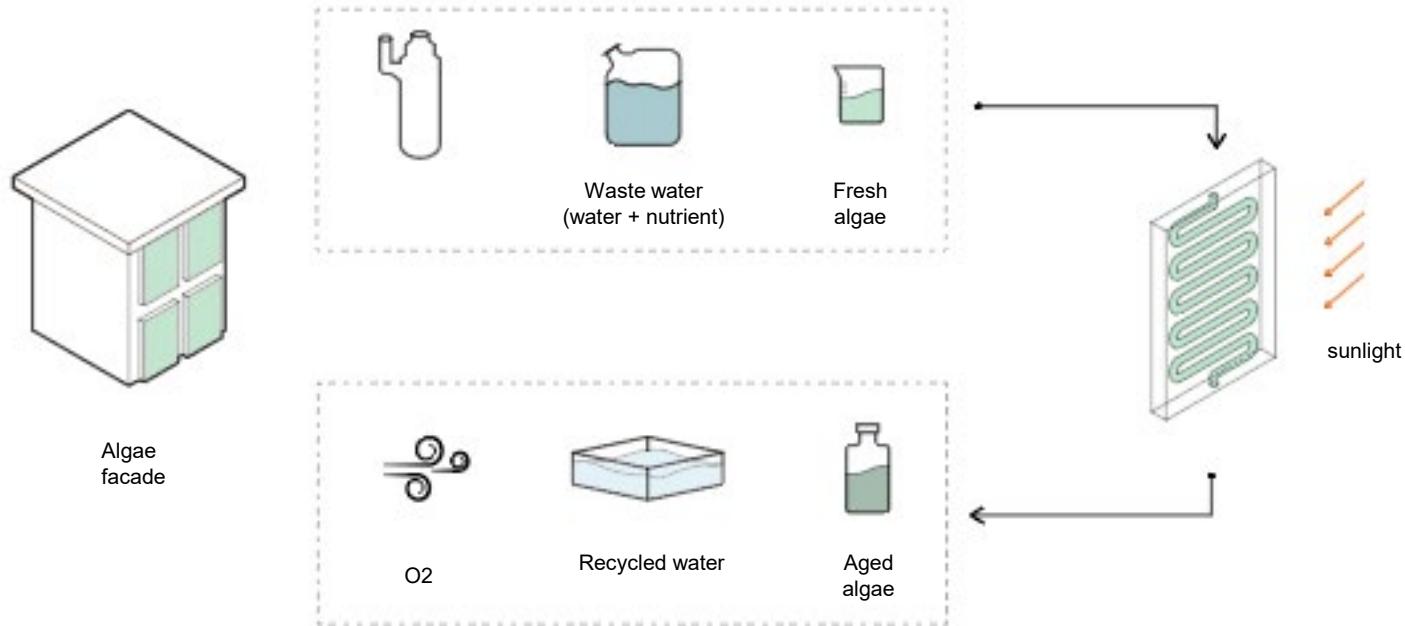
Instructor | Mania Aghaei Meibodi

ARCH 708 | System Engagement | Final Review

Fall 2022

Research

Research | Algae facade reaction process



Research | Microalgae Photobioreactors (PBRs)

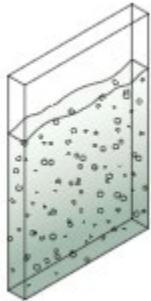
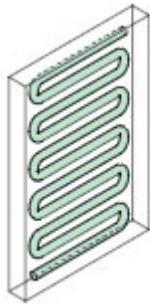
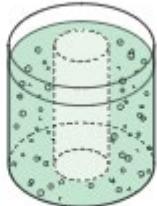


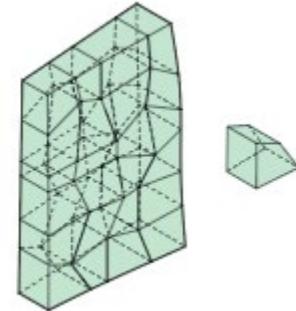
Plate
Fixed geometry
Cumbersome
Algae Sediment
Laminar flow



Tubular
Fixed geometry
Cumbersome
Constantly density of algae
Laminar flow



Annular
Fixed geometry
Cumbersome
Algae Sediment
Turbulent flow



Breathing Brick
Variable geometry
Lightweight
Constantly density of algae
Turbulent flow

Flow type

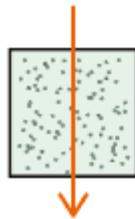


laminar flow

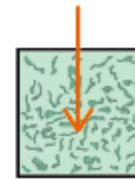


turbulent flow

Sunlight

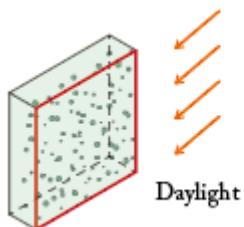


fresh algae section



aged algae section

Surface / Volume Ratio



Daylight

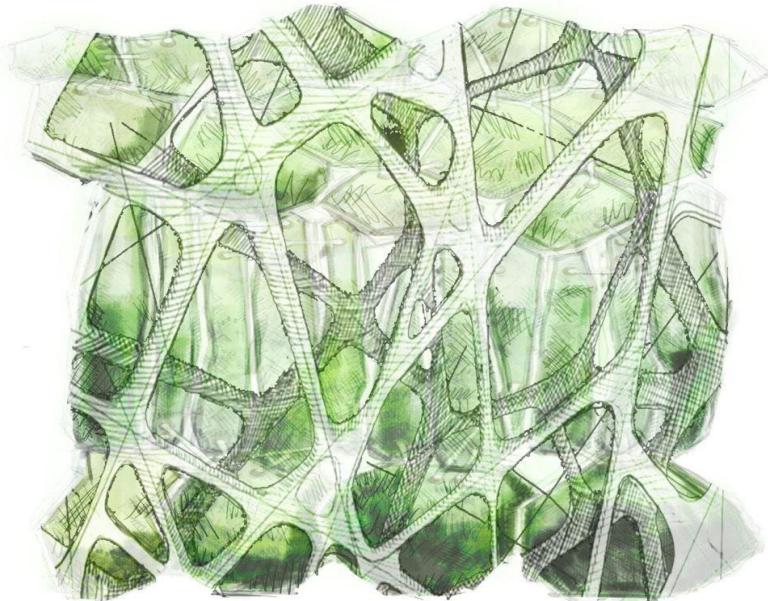
$$\text{ratio} = \frac{\text{surface}}{\text{volume}}$$

Sediment

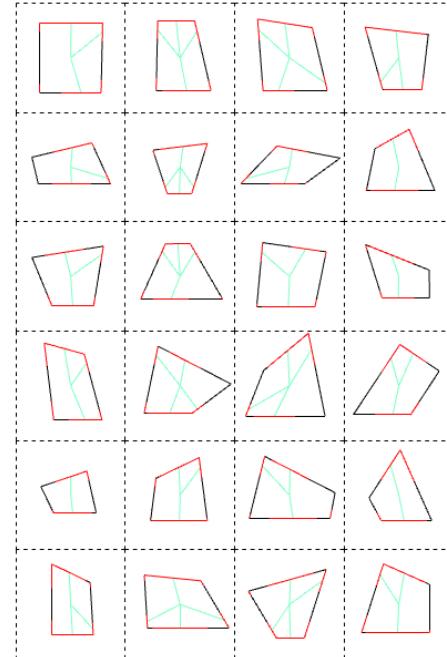
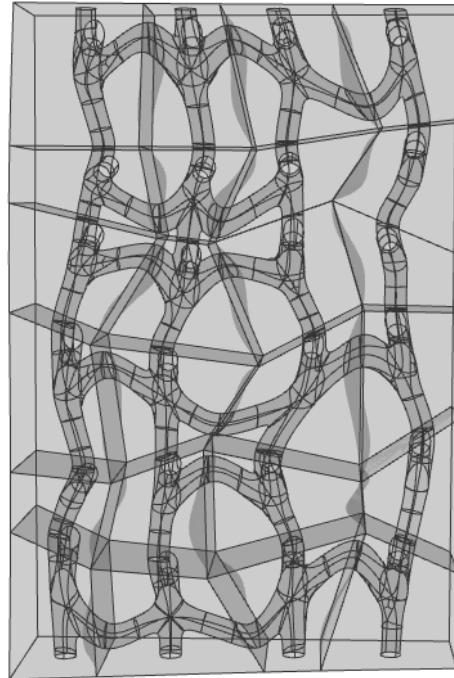
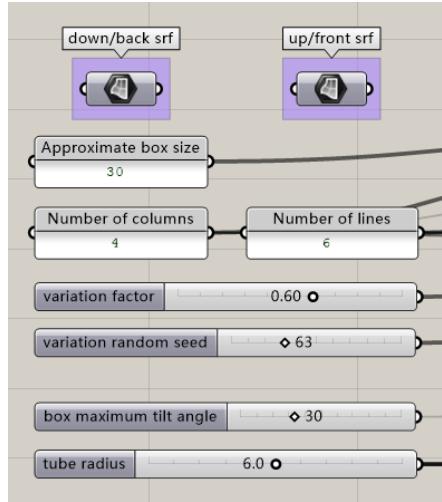


Design

Design | Concept



Design | Parametric generation

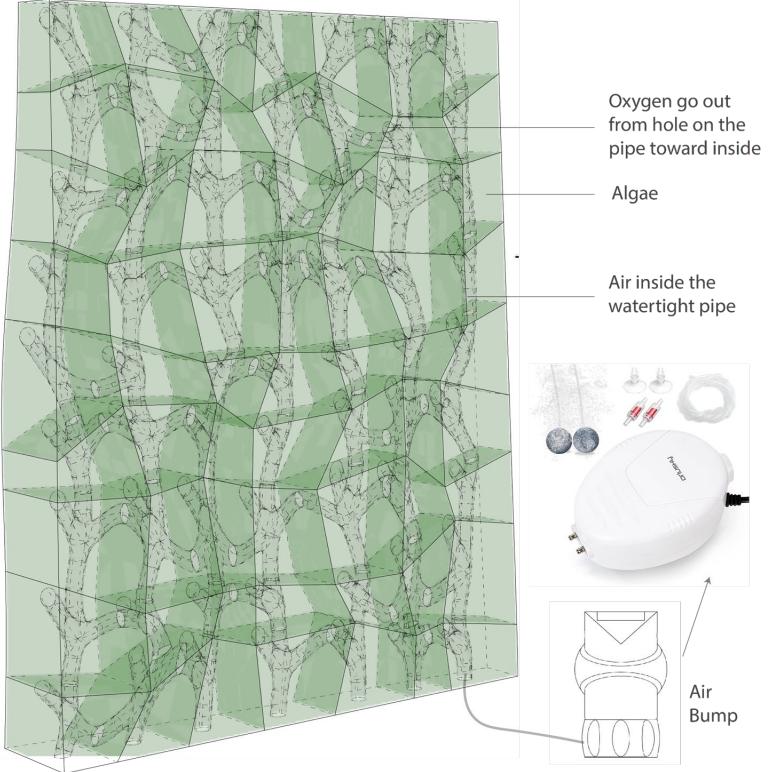
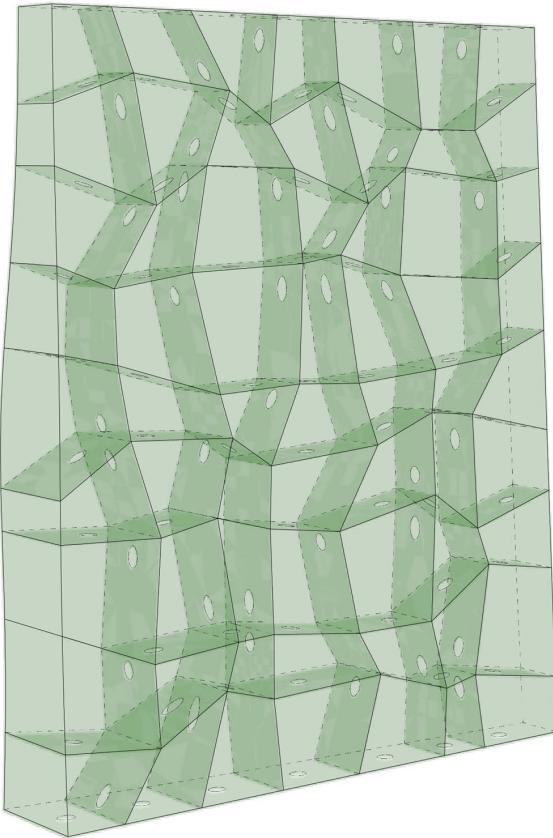




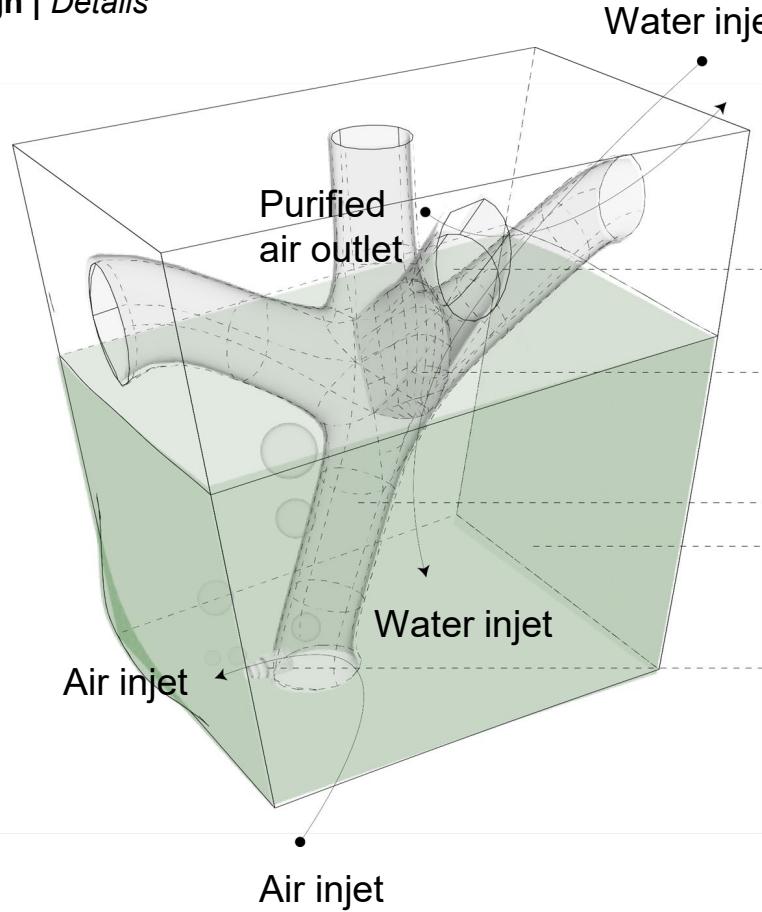


Working Principle

Design | Usage scenario 1 | Wall System



Design | Details



Purified air outlet

Pipe:

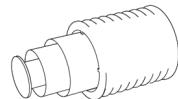
For air with O₂ and water inject

Sealed surface:

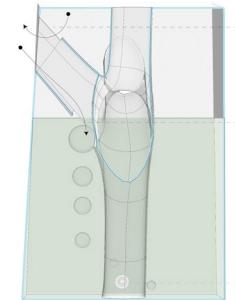
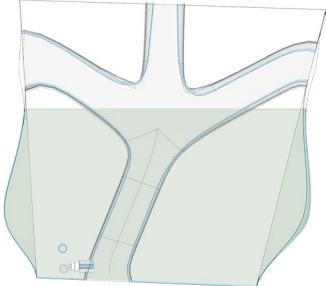
Keep pipe water tight

Pipe: for air with CO₂

Water and algae



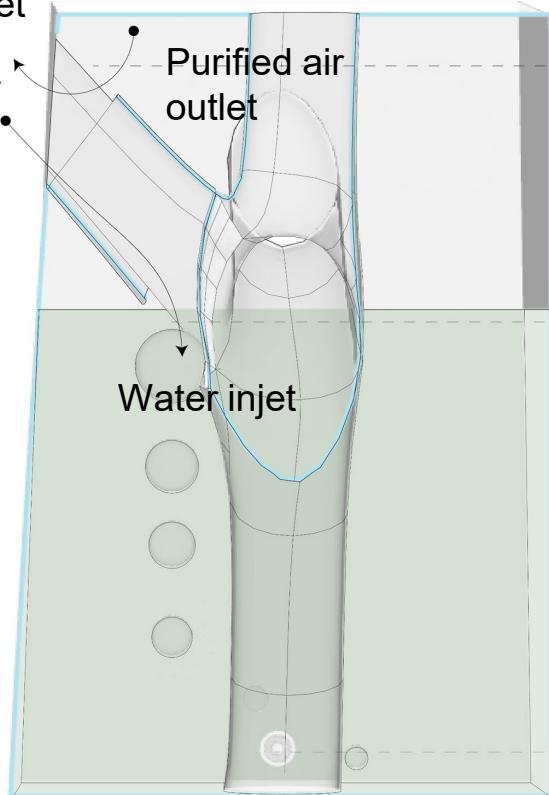
Water stop valve
Air inject and water stop



Design | Details

Purified air outlet

Water inject

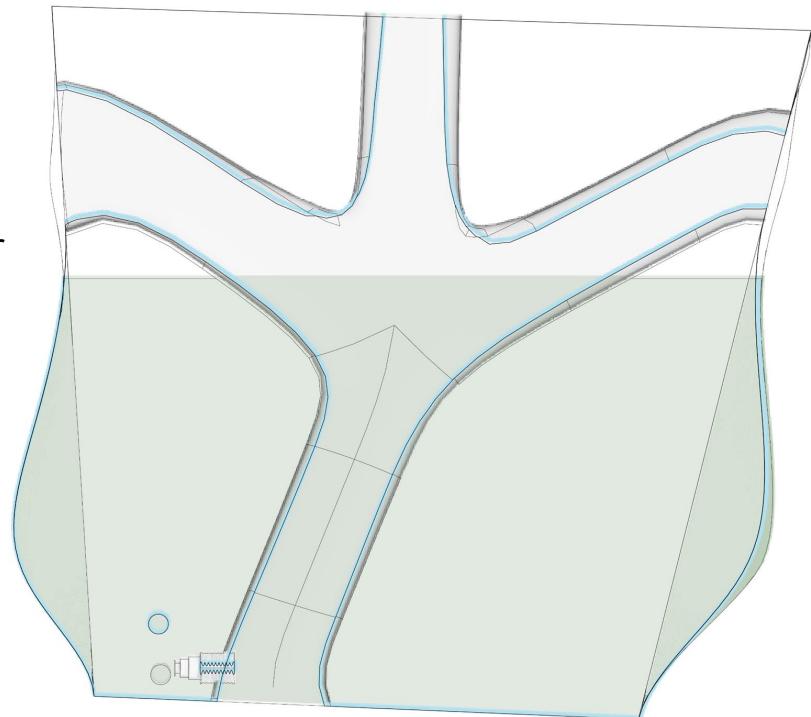


Opening for purified air

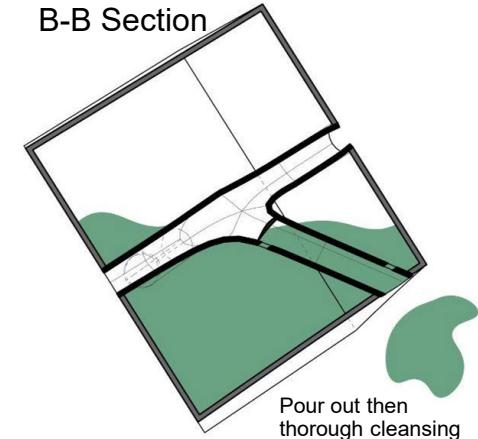
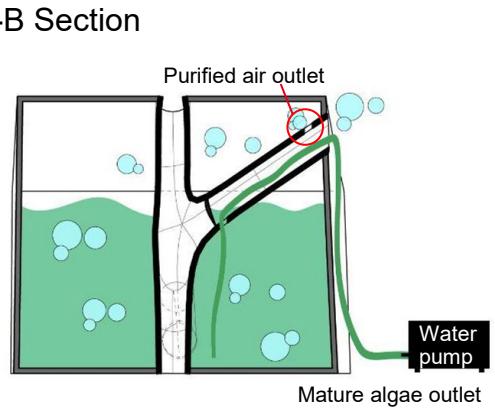
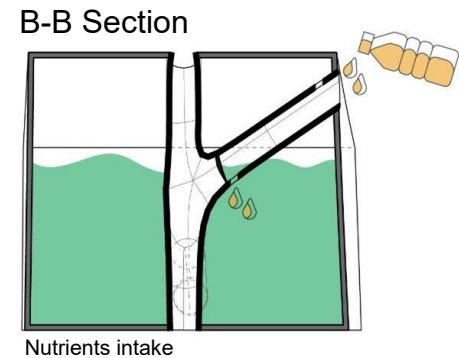
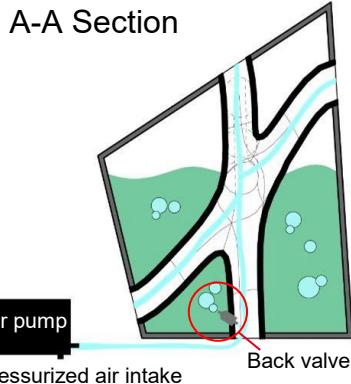
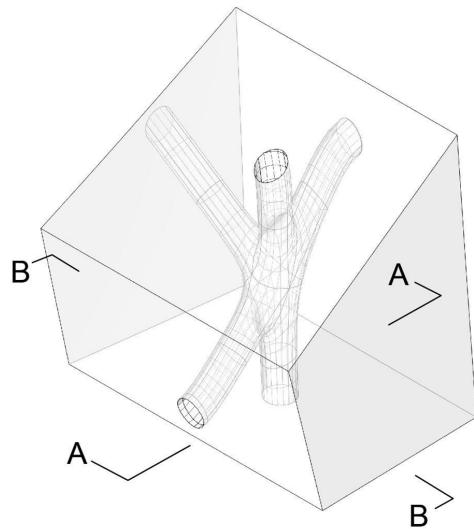
Opening for water

Sealed surface

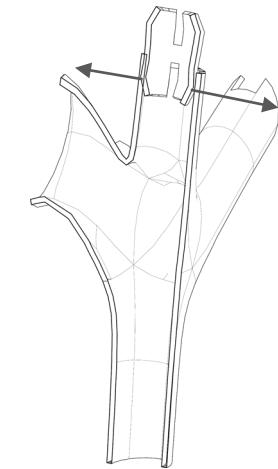
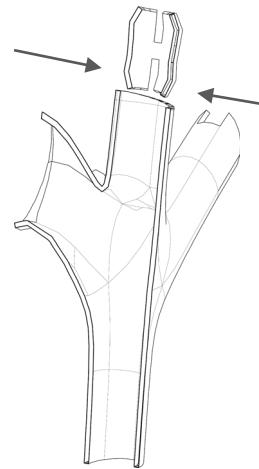
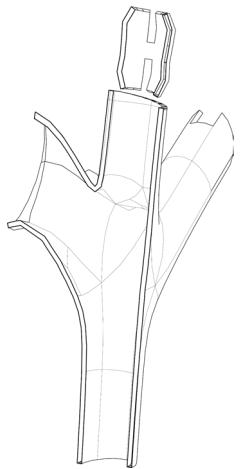
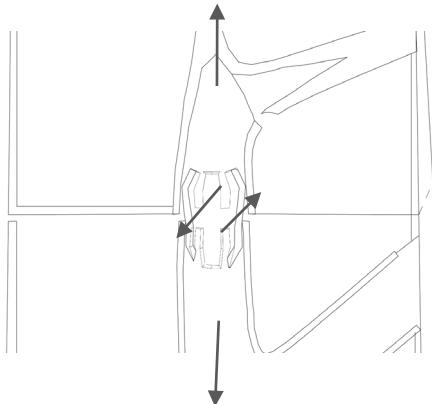
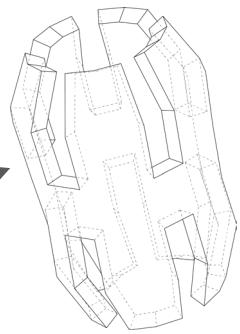
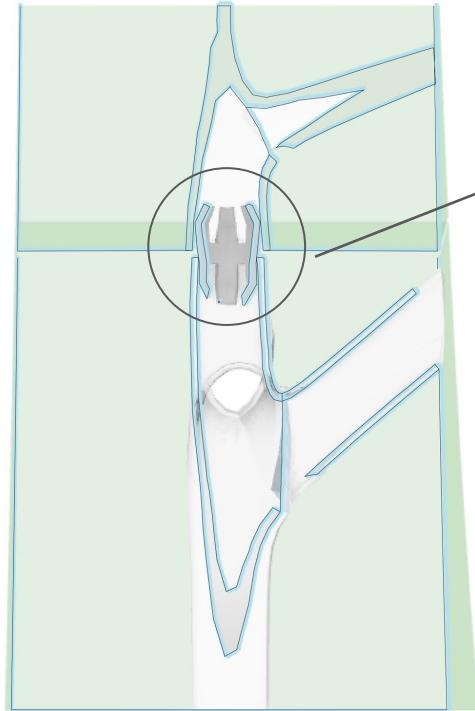
Water stop valve

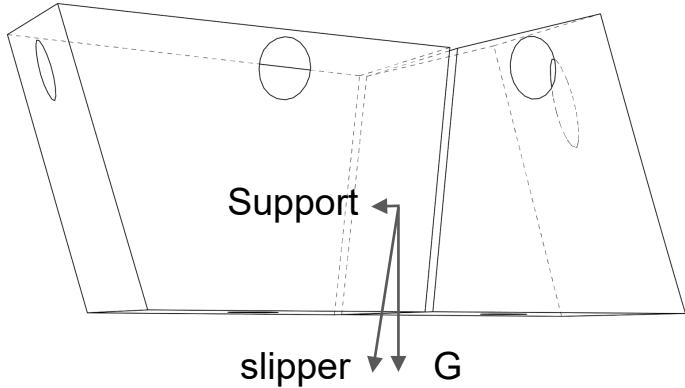


Design | Usage scenario 2 | Standalone

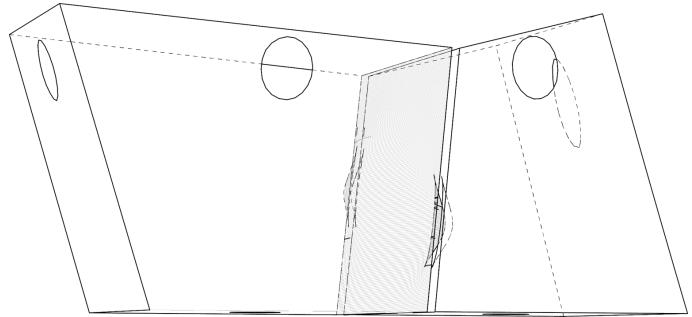


Design | Joint





Traditional Flat Interface
Support is wake, gravity may cause
slippery and shift

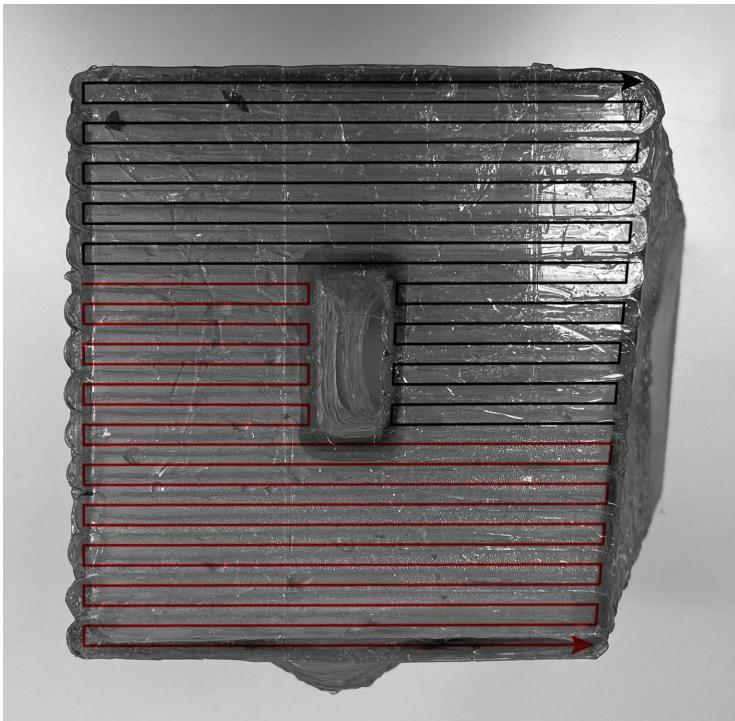


Innovated Interface
Make surface interlocking with
each other to provide more
support and accuracy

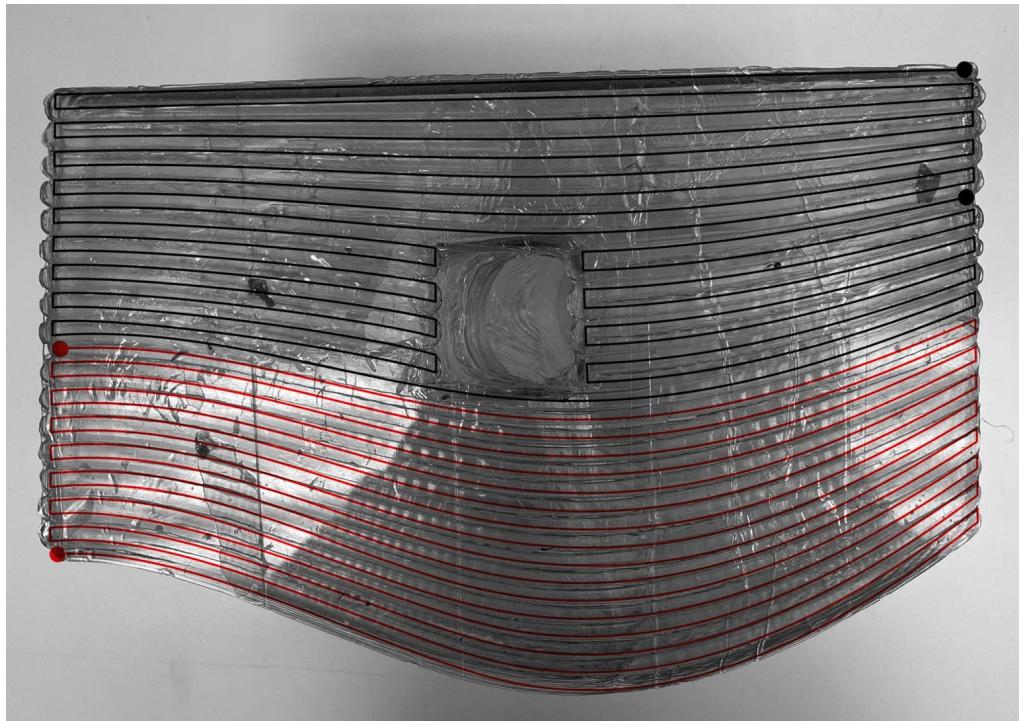
Printing

Printing | Bottom surface | Toolpath_test01

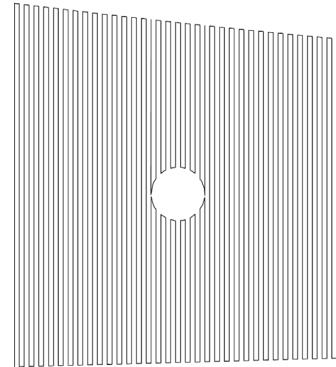
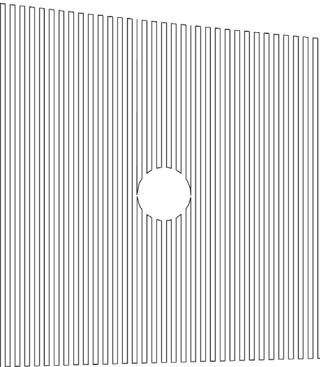
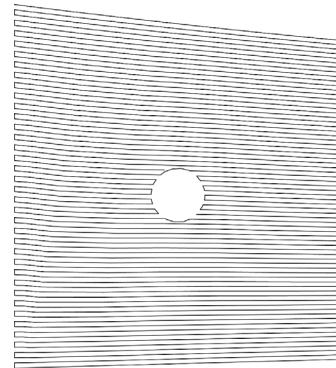
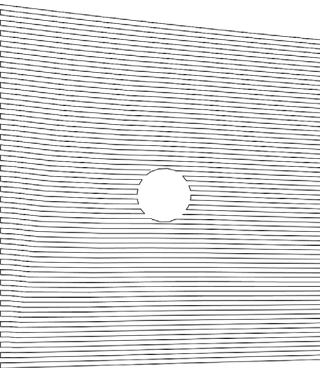
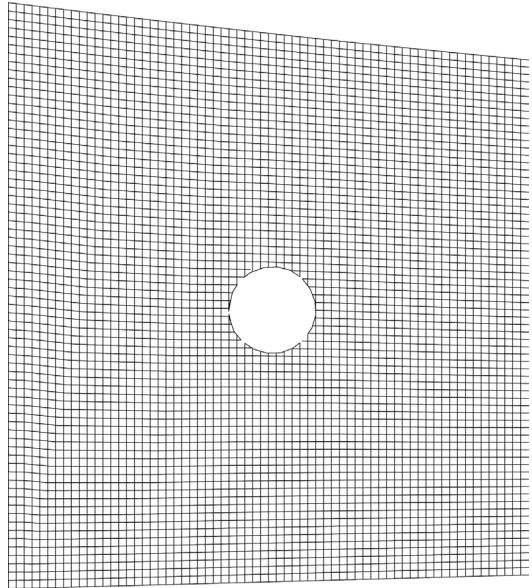
Brick 01



Brick 02

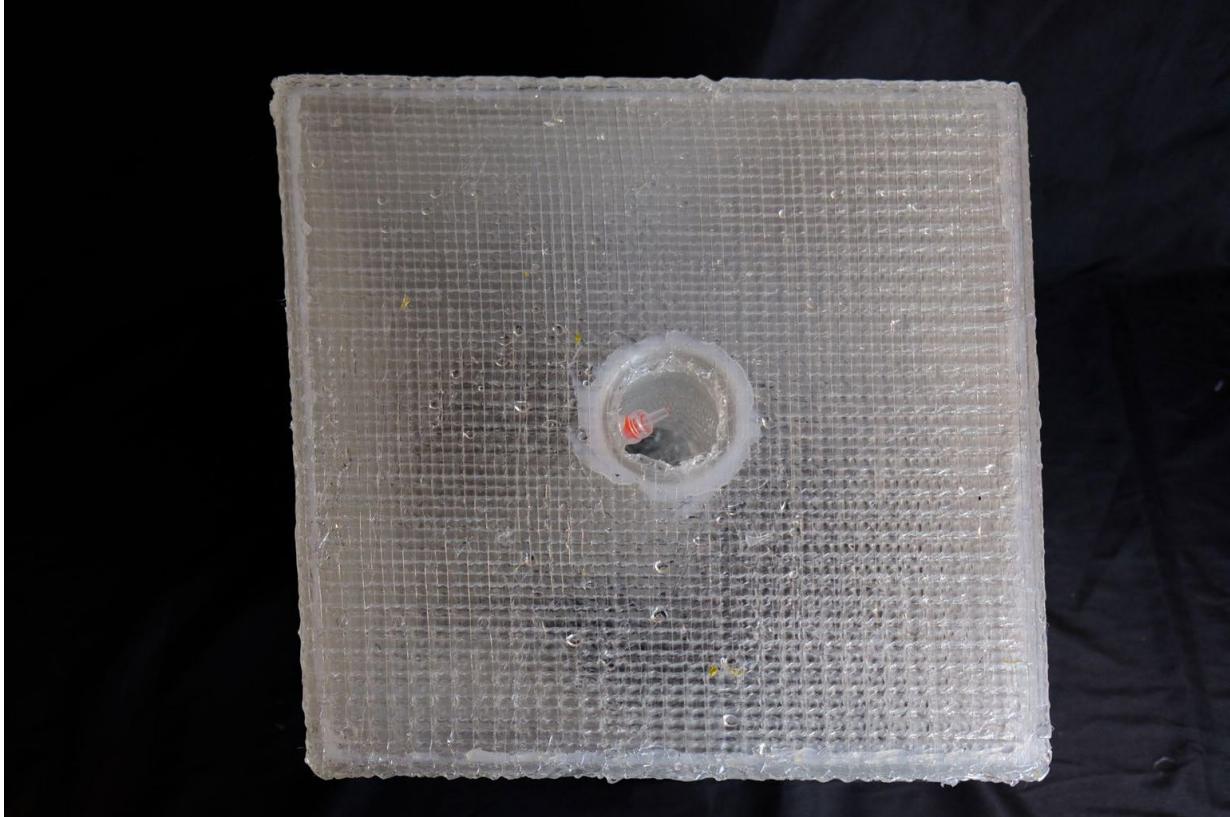


Printing | Bottom surface | Toolpath_test02

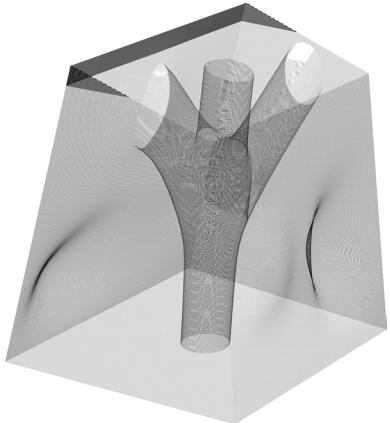
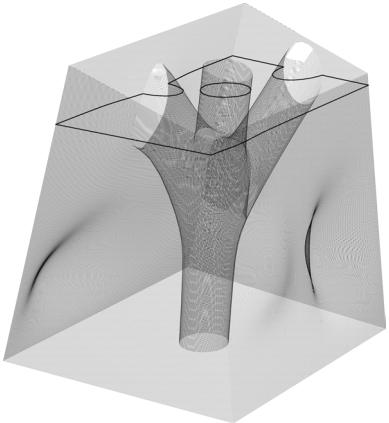
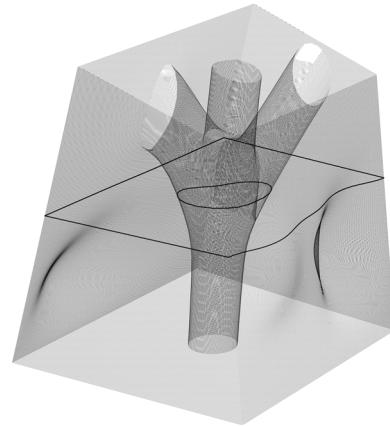
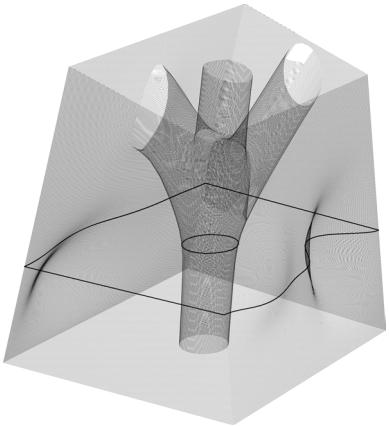
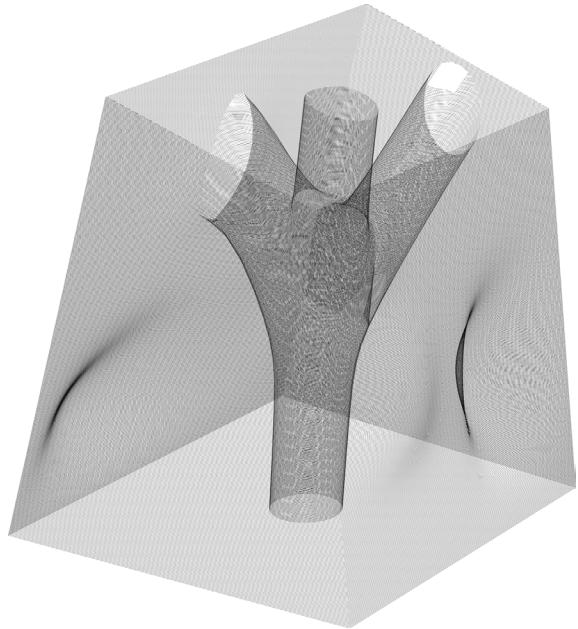


Ref. Idea from Ali, Abdallah and Jake

Printing | Bottom surface | Toolpath_test02



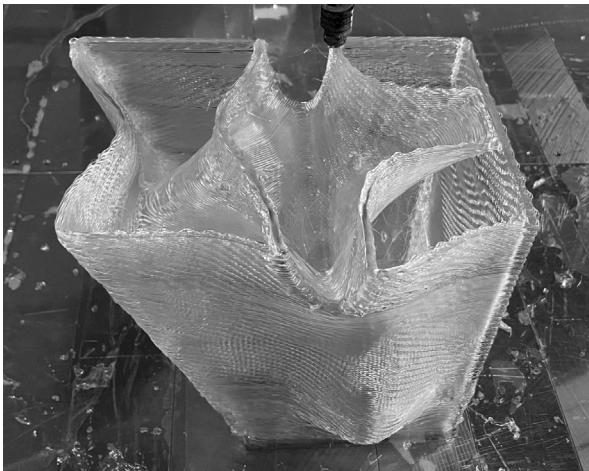
Printing | Toolpath



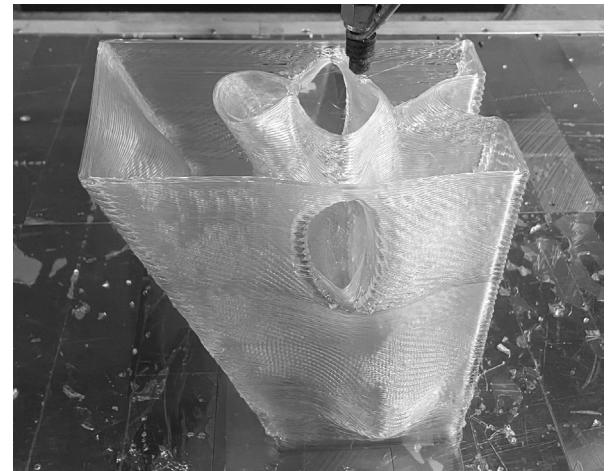
Printing | 3dp



Step 01



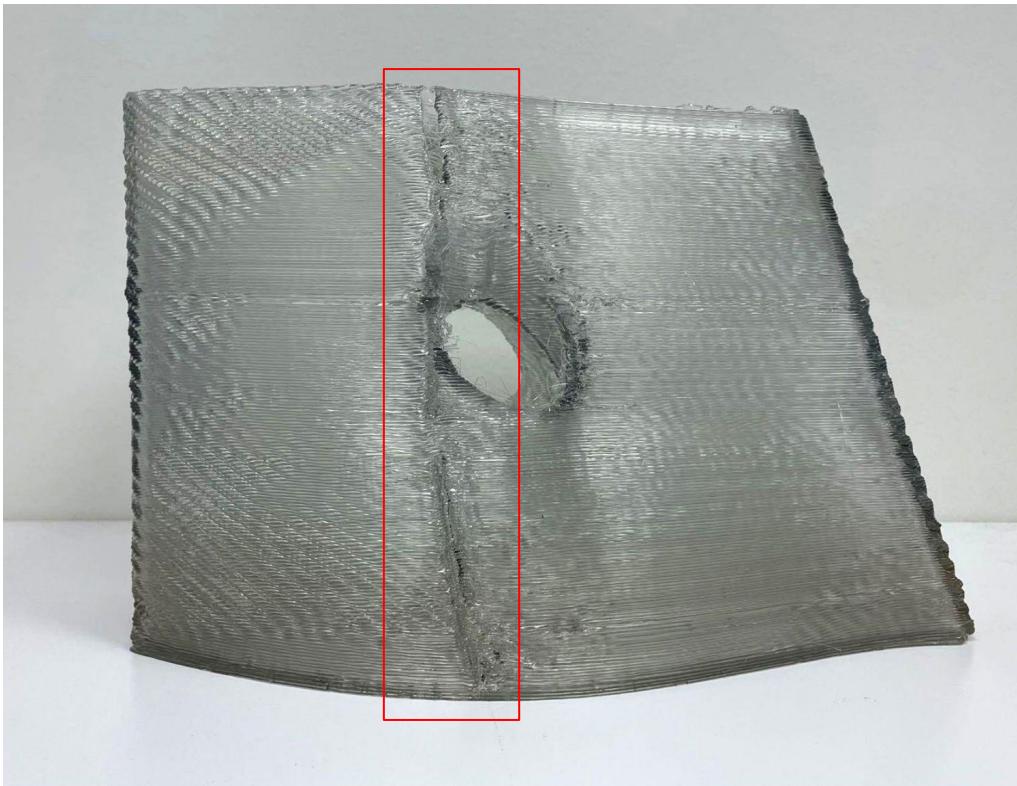
Step 02



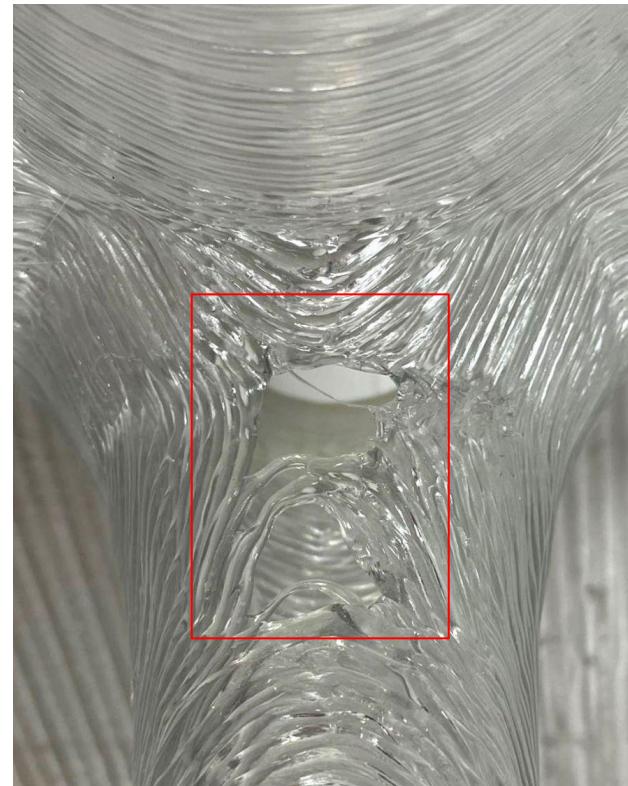
Step 03

Printing | Test 01

Seam



Overhang



Printing | Test 02

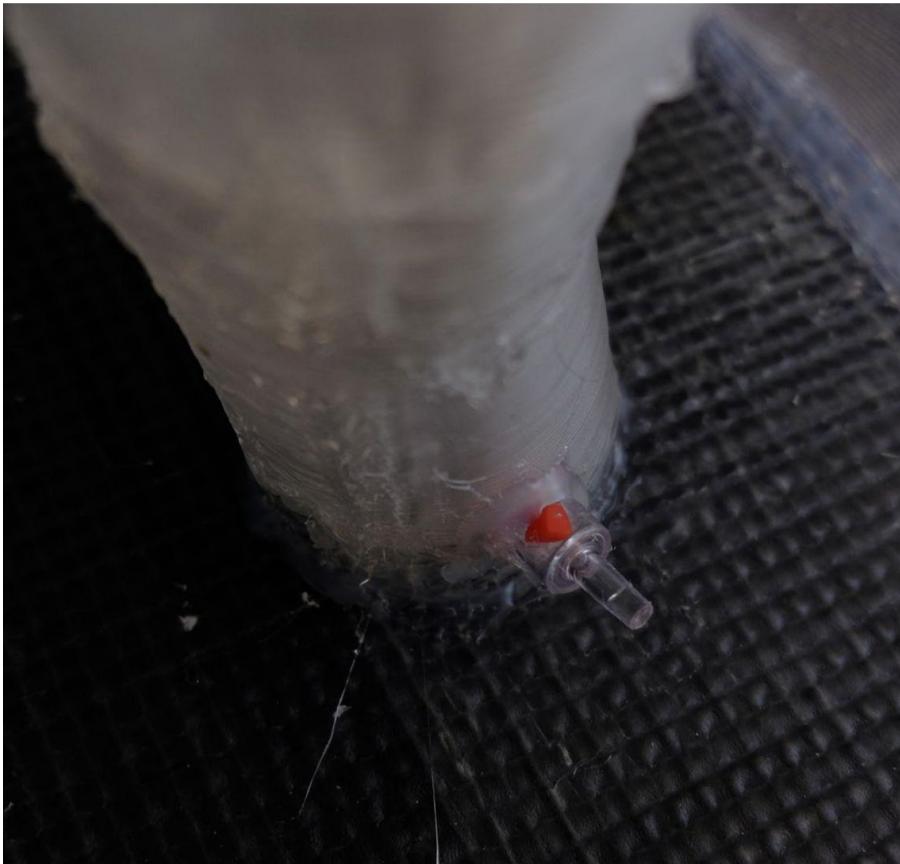


Breathe Brick

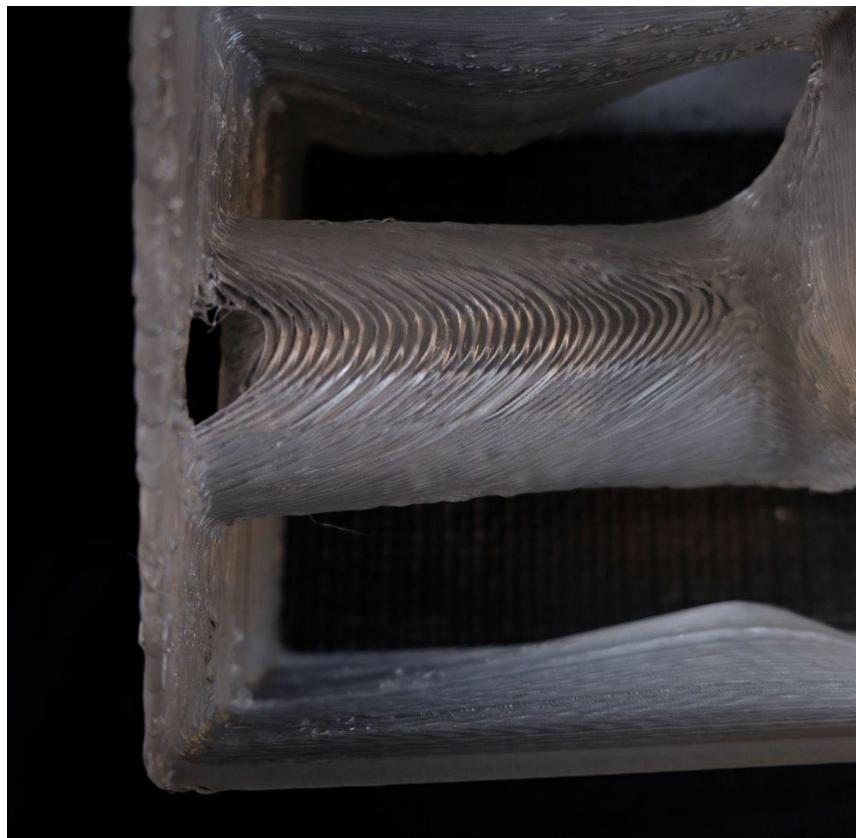


2022 | Fall | Arch 708 | System Engagement

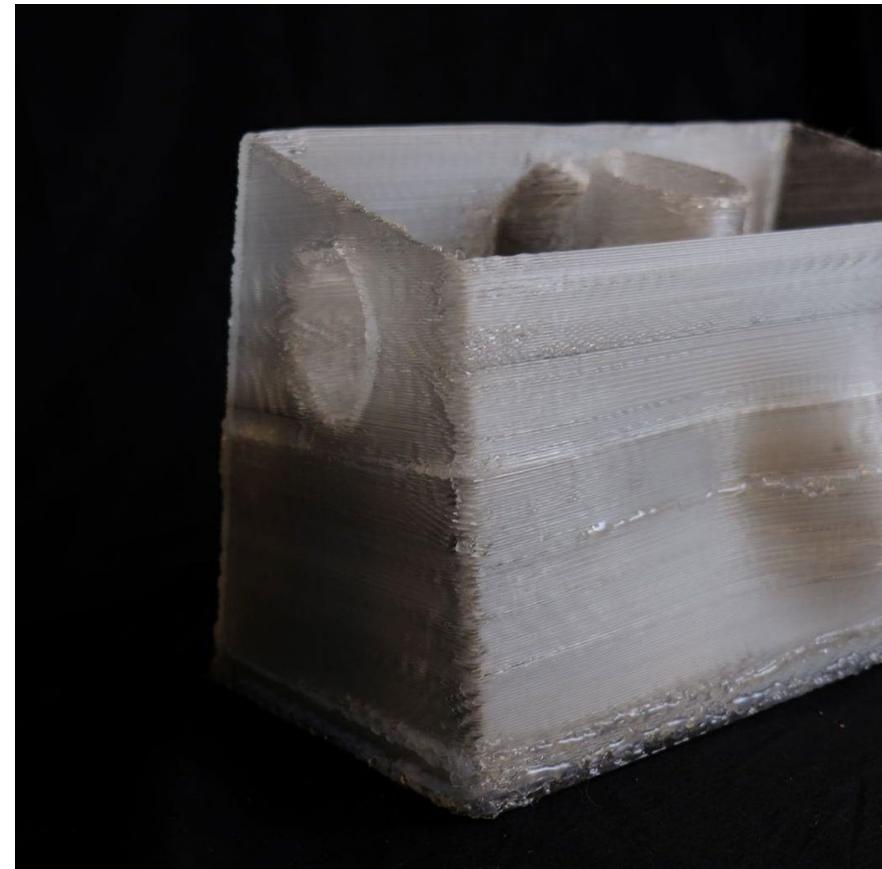
Printing | Air Inlet



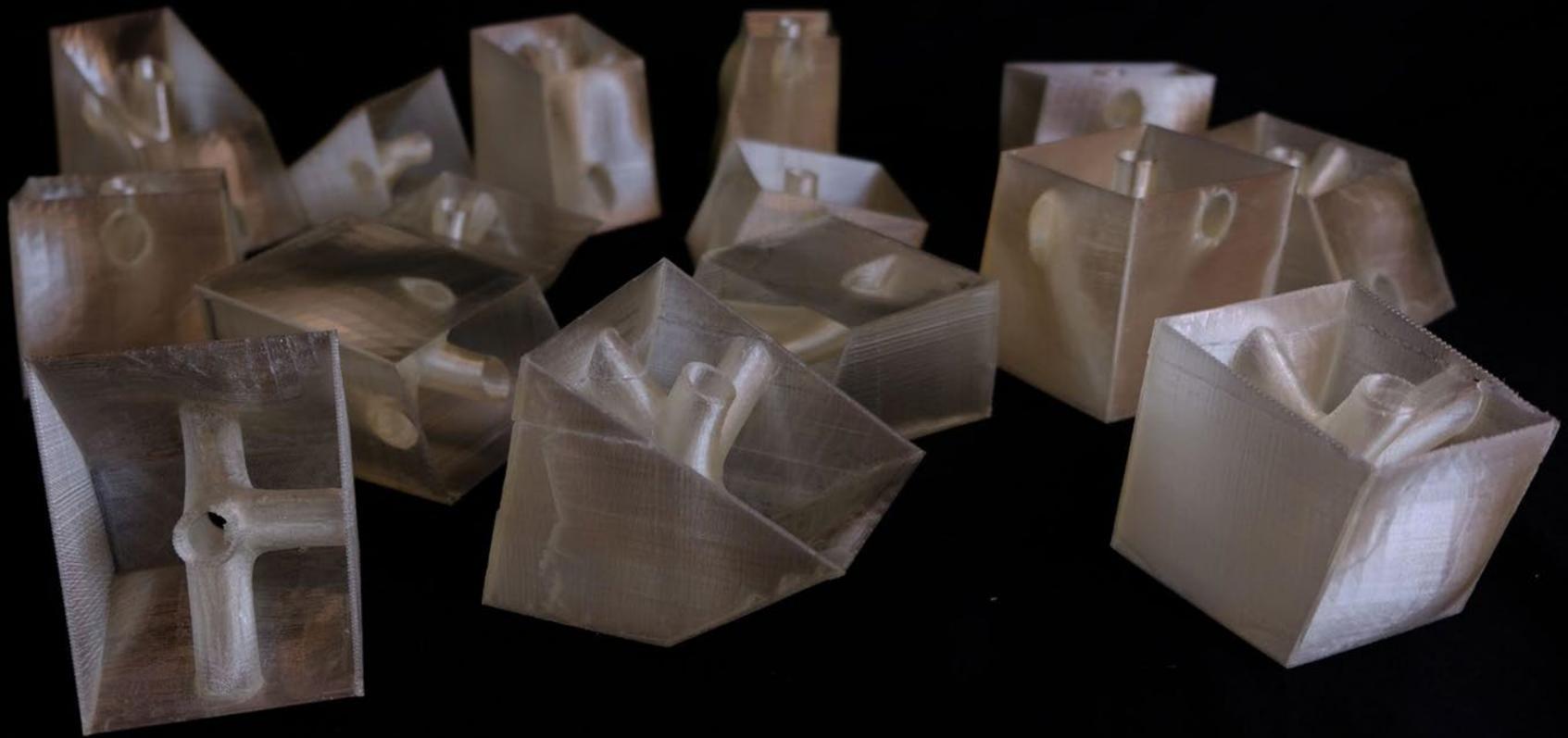
Printing | Air outlet

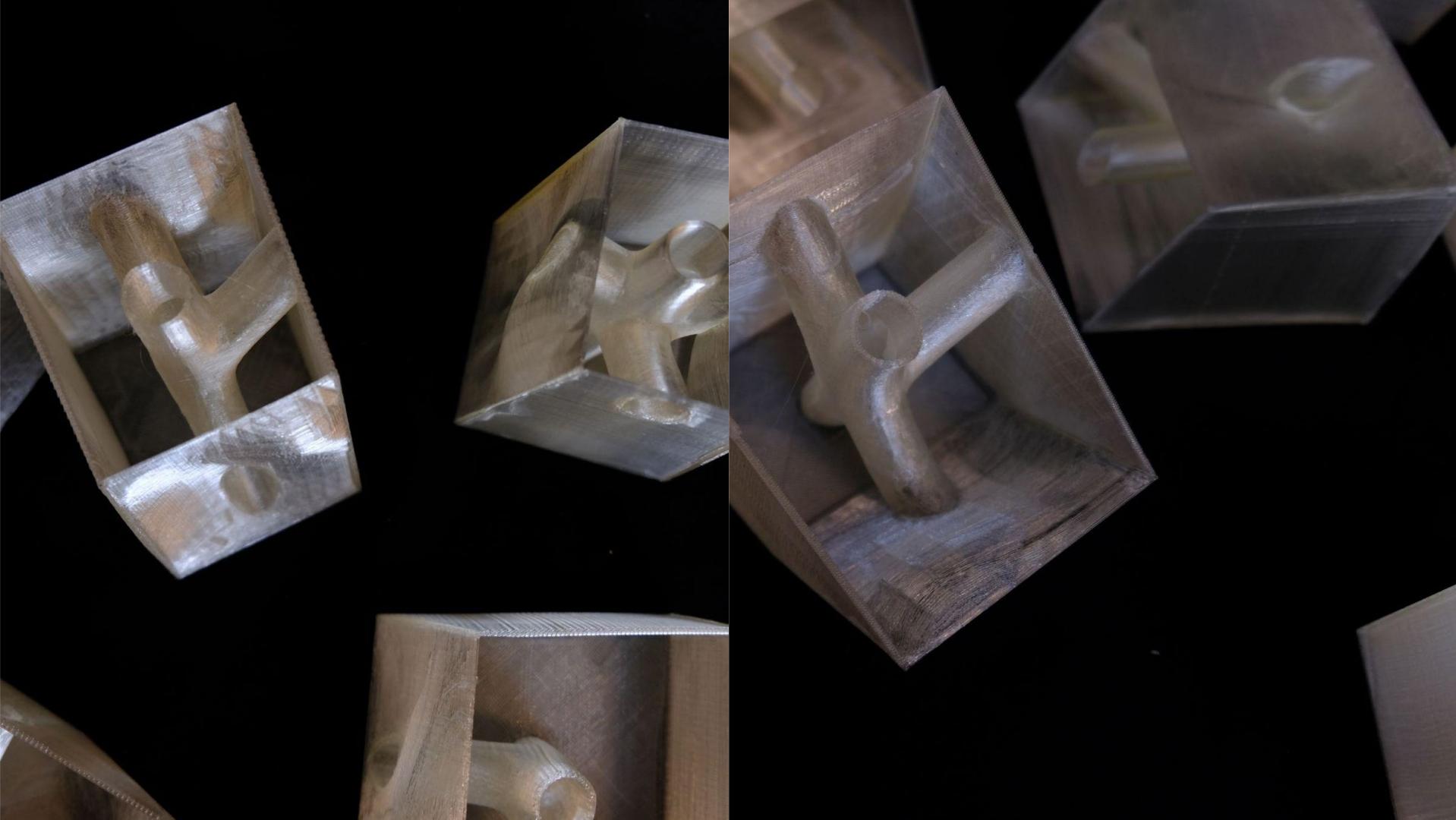


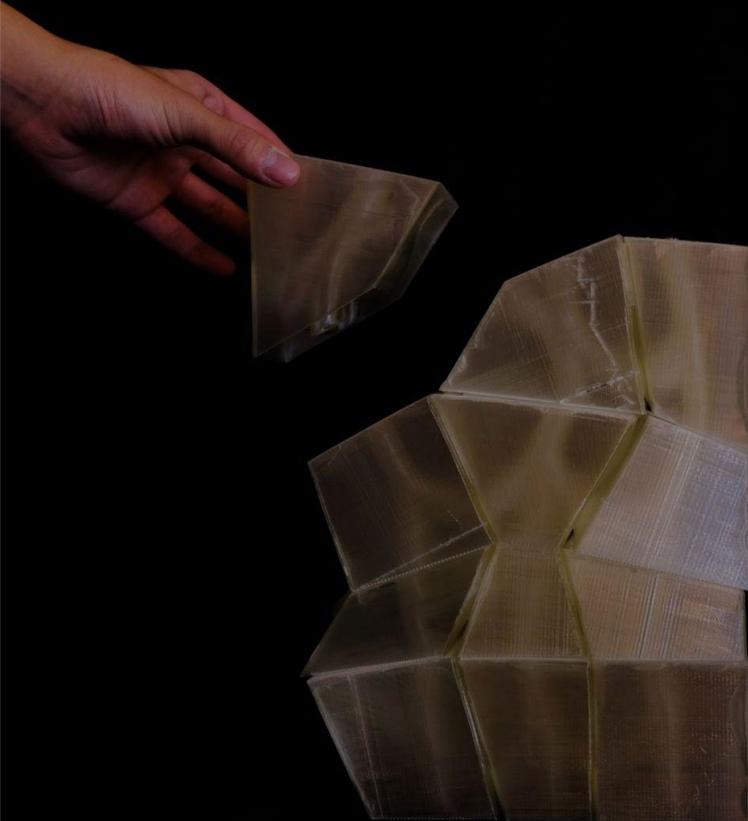
Printing | Water inlet /outlet

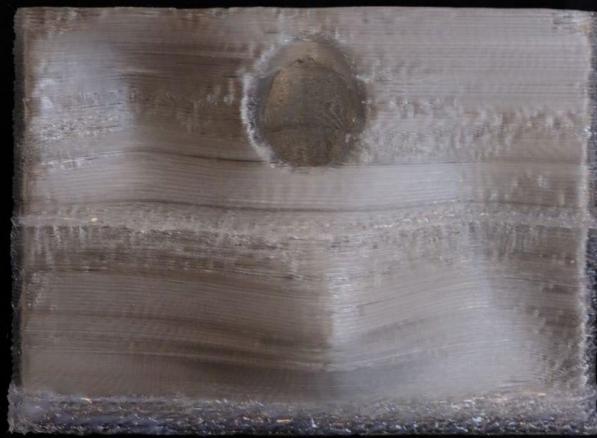


Assembly













Thank you!

