Pompidou 2
Design & Fabrication of Indoor Infrastructure for Living Systems

6.0 Credit | 12h x 10 weeks | Instructor: Mary Polites | Office: 263 Onyx Hall Bridge | Email: mpolites@uoregon.edu | Office Hours: By appointment
Class times: M/W/F 1:00 – 4:50 pm | Room: Lawrence 377

Course Description
In the architectural climate of the Anthropocene, there is an increasing demand for the design of living systems (plants) in our built environment. Many factors drive this desire, but notably those of human health impacts and a lack of connection to nature. Our strategies for integrating living systems need to be revised as they approach the relationship with plants just as they have been since its popularization during the Victorian Era. During this period, plants were brought indoors for our enjoyment, made possible from pots and containers. This vessel design continues in our current practices, despite the fact that we understand better the behavior and needs of plants today thanks to science and technology.

The Centre Pompidou in Paris by Richard Rogers and Renzo Piano turned architecture inside-out by placing its structure and mechanical systems externally, allowing the interiors to be easily rearranged. In this studio, we will examine building systems with the aim to integrate them with living systems for indoor spaces. We will question what systems we can expose, where they occupy our space, what species might be best accompanied by these systems, and how this can impact and change the use of our built environment. The outcome of this studio will propose designs for interior architectural applications that integrate living systems.

Design Build
This studio will design concepts with 3D models and develop physical prototypes through digital fabrication. Students will start with study models and move to 1:1 at scale mock-ups to accommodate species and test their growth strategies on these models.

Software & Fees
This studio will require the intense use of Rhino and Grasshopper. Previous working knowledge of Rhino is advised. Tooling up in Rhino before the course is advised if you are a beginner. If you are on a Mac you will need to have a working PC side for these programs, as Rhino and Grasshopper for Mac are not compatible with some of the provided tools.
While this course will not have additional fees; students should be prepared to pay for material and machine hours for digital fabrication. We will be using resources in Lawrence and the Knight Campus.

**For more examples of this work head to: https://maps.network/CFAR-Exhibition**
Course Objectives

Upon completion of this course students will have:

- Understanding of interior infrastructure systems (HVAC, Sprinklers, Mechanical & Plumbing)
- Understanding of living systems and how architecture can integrate these systems
- Gain skills needed to design and fabricate through digital fabrication
- Gain skills in parametric design & VR representation
- Gain experience in working across platforms of Rhino, Grasshopper, InDesign & digital and analog fabrication

Course Phases

This studio will be divided into three phases, each compounding on the next. In each phase we will be studying pattern and the integration of living systems for architecture.

Material Phase

Melt electrowriting (MEW) is an emerging 3D printing technique that enables the fabrication of continuous threads of polymers into 3D ‘scaffolds’. The technique has been most widely applied to tissue engineering research by fabricating scaffolds that mimic the native structure of biological tissues, onto which human cells can be seeded to regrow damaged or diseased tissues and organs. MEW prints fibers at the micron-scale, thinner than a human hair, which makes them an ideal substrate for cell attachment since cells can interact with the fiber networks at a scale unachievable with other extrusion 3D printing techniques. The technique was pioneered by Professor Paul Dalton, who is now based at the Knight Campus and has established a world-class research laboratory centered around this cutting-edge technique. We will begin with an exploration of living systems at the micro-scale, which focuses on materials studied through the integration of pattern and MEW scaffolds.

While mammalian cell interactions with MEW scaffolds have been widely studied, little is known about how plant cells can grow and interact with these intricate microfiber structures. This project presents an opportunity to explore and discover the potential for using MEW scaffolds to guide plant-based living systems, incorporating scaffold design with biomimetic materials into our built environment.
Component Phase

We will continue exploring the concept of patterns and systems by focusing on a single unit that can repeat to achieve an architectural system. In the Component Phase, we will be looking at how we can generate 1:1 models quickly that will support living systems through existing infrastructure connections. Lawrence Hall will be the focus of our study, and we will select sites of intervention that connect to the existing infrastructure. Each component will need to support a living system, connect to an infrastructure, and propose a pattern that is either a wall, ceiling, floor, or column. In this phase, we will use analog methods of developing components and transferring concepts into digital models for study.

Rhizome Wall Component Patterns
Maps 2021

Rhizome Wall Assembly
Maps 2021

Architectural System Phase

In this final phase, we will take the component and iterate this pattern into a complete architectural system. This system will be printed at a prototype scale (not 1:1) through digital fabrication. The final design of the component and architectural system will receive plantings to convey how the form, growth media, and species might work in an actual installation. The final presentation will be a mix of digital models, plants, and existing infrastructure explored through presentations using VR techniques. These models will need to be planted in the greenhouse before the final presentation, allowing for 5 days of growing time.

Rhizome Wall VR Mockup
Maps 2021

Rhizome Wall VR Mockup Detail
Maps 2021

Rhizome Wall Render
Maps 2021
Course Outline and Schedule*

*Subject to change at the discretion of the instructor

Week 1 (01/09): Material Phase - Patterns & Systems
- Digital Bootcamp
- Rhino Introduction
- Grasshopper Introduction
- Students tool up in how to develop MEW scaffold patterns & visit Knight Campus

Week 2 (01/16): Material Phase - Pattern Generation
- MEW Scaffold Pattern Designs Presentation Monday Jan 16
- Critique from Knight Campus Experts
- Final Designs for fabrication Due Friday Jan 20th

Week 3 (01/23): Component Phase - Case Studies
- Building Systems Case Study
- Lawrence Hall buildings systems review
- Building Systems Presentations Friday Jan 27

Week 4 (02/06): Component Phase - Pattern Generation
- Indoor Species Lecture
- Students develop components using 1:1 analog modeling
- Design Categories - Walls, Floors, Ceilings, Columns

Week 5 (02/13): Midterm
- Students continue to design & refine component systems for architectural design category
- Midterm Presentation Friday Feb 18th

Week 6 (02/20): Component Revision
- Revision of component system
- Develop pattern option for architectural intervention
- Select accompanying specie
- Select location of study

Week 7 (02/27): Architectural System Phase
- Digital Fabrication - Students 3D print component systems - trial scale (not 1:1)
- Analog 1:1 development - students continue to refine full scale prototype
Week 8 (03/06): Architectural Systems – Fabrication & Planting

- Digital Fabrication - trial scale (not 1:1)
- Once completed - plant and move to greenhouse
- Final Presentation Prep
- All 1:1 fabrication completed and planted Friday 3/10

Week 10 (03/20): FINAL REVIEW WEEK – no classes

Week 11 (03/27): EXAM WEEK / EXHIBITION