# Welcome to 20.S947: 3D scientific Rendering

---

## 1. Course Details

**Prereq**: None
**Units**: 1-0-1
**Room**: 56-154
**Schedule**:

- JAN 18, 2023 - 10:30-11:30AM
- JAN 23, 2023 - 10:30-11:30AM
- JAN 25, 2023 - 10:30-11:30AM

## 2. Introduction

Welcome to 20.S947! This course is designed to progress everyone from beginners to confident users of 3D rendering software with a focus on biological and chemical scenes. The course will provide an overview of 3D modeling, realistic materials, and scene composition. By the end of the course, students will feel comfortable working with Blender, the leading 3D open-source software, for whatever projects come up.

While the course will be in person, all lectures will be provided asynchronously. I will try to post the lectures to YouTube on the same day. However, there may be a delay as I clean up the recordings. The class will generally follow a live demo format, where everyone can follow along as I demo the renders live using Blender. Since the course is only three days, each lesson will be fast-paced, and there won't be much time for questions. To answer any questions, I will be available any time after class and outside of class, either in person, over Zoom or email, to go over the concepts in detail as much as you need!

Just as a warning, 3D rendering software can feel very complex and is not beginner friendly, so don't worry if you feel overwhelmed! That is perfectly natural, especially during Lessons 1 & 2. However, as you play with the software more, it will begin to feel more familiar. Also, all the lectures will be recorded, so you can go back and watch the lectures as many times as you need. Also, I have posted detailed notes in the Modules section of the course Canvas for each lecture that has every step written out. That way, you can focus on absorbing the content instead of taking notes.

# 3. Course Schedule

## 1.1. Lecture 1: The 3D Viewport and Lighting

*JAN 18, 2023 - 10:30-11:30AM*

For many of you, this will be your first introduction to the world of 3D modeling. At first it will feel foreign, and you will likely find yourself wondering, *how can I possibly remember all this?* Don't worry! Everyone feels this way when they start. In fact, this first lesson is designed to make you feel that way. By the end of this lesson, you will have seen EVERYTHING you need to make a high-quality journal cover. The next three lessons will reinforce what we learn today and introduced more advanced topics.

- **20.S947: Intro to 3D Scientific Rendering** 5 min
- **Converting molecular structures to 3D meshes** 10 min
- **Basics of manipulating molecular structures in Blender** 15 min
- **Experimenting with Blender materials for molecules** 10 min
- **Experimenting with lighting for molecular scenes** 5 min
- **More realistic Eevee render settings** 5 min
- **Stylize your molecular scene with the compositor** 5 min

**Total Time** 55 min

## 1.2. Designing a Scientific Journal Cover

*JAN 23, 2023 - 10:30-11:30AM*

Congratulations on finishing the first lesson! I hope it wasn't too overwhelming. In this next lesson, we will be using our render from the previous lesson to design a journal cover. We will pull from what we learned in the previous lesson but will also introduce almost all the topics you will need to consider yourself a Blender expert. You should feel a little overwhelmed after this lecture but trust me that is the only way to learn 3D modeling!

- **Viewing your molecular scene from the lens of a journal cover** 15 min
- **Using environmental textures to improve molecular scenes** 10 min
- **Adding procedural material to molecules** 10 min
- **Adding realistic PBR material to molecules** 10 min
- **Create a dust and smudged lens effect with Blender's compositor** 10 min

**Total Time** 55 min

## 1.3. Scientific Animations and Movies

*JAN 25, 2023 - 10:30-11:30AM*

Hope you appreciate how far you have come. Using the skills, you have learned in Lectures 1 & 2, you will be able to render just about any still scene given a starting structure. However, there is one last topic I would like to introduce you to, and that is Animations. Being able to render

scientific movies and animations can be a powerful tool for community outreach and getting your work scene. In this lesson, we will take the final scene from lesson 1 and turn it into a simple movie showcasing the binding of a peptide to the MHC pocket.

- **Animating a ligand binding** 15 min
- **Creating a looping animation effect** 10 min
- **Creating predictable dust particles that appear random** 15 min
- **Rendering and processing an animation in Blender** 10 min

**Total Time** 50 min

# 4. Grading Policy

This is meant to be a fun, low-stress course that introduces you to many concepts you need to create impressive scientific renderings in 2023. The course will move very fast and will cover a lot of material in a very short amount of time. However, many of you are entering with very different backgrounds and skill levels. Some may have never touched 3D software before, while others may have published 3D-rendered journal covers. The range of skill levels makes it impossible to evaluate how much someone has "learned" during the course. The only person who knows how far you've come is yourself. For that reason, this course will be self-graded, where each student can evaluate their progress at the end of the course.

# 5. How to Learn in this Course

3D rendering and illustration are more art than science. This means there will be many ways to approach learning in this course. The first and least stressful way is to watch the lectures while I live demo every step of every render and try to absorb by listening instead of spreading yourself thin by trying to follow along. Then later in the day, when I upload the lectures, try and replicate them at your own pace.

The second way will be to follow along with me. This is the best way to master the material. However, it will be challenging, given the amount of material. If you plan on taking this route, stay as focused as possible during the lecture, as it will be very easy to fall behind.

I have included some useful documents in Canvas that should help all learning styles. First, you will find a document called Lecture-X_Notes.pdf for each lecture. This included every command and shortcut in the lecture and some descriptions and explanations. Also, there is a zip file called lecture-files.zip. This contains all the files that you will need to complete the lectures. It also includes my finished Blender files if you want to compare specific values.

The most important, however, is practice. If you have time, try rendering something for an upcoming presentation or rewatch one of the lectures that you found particularly challenging! For those who enjoy this class, make sure to join next IAP. I will try to make this a reoccurring activity with all new lectures and projects!

# 6. Contact

## 1.4. Office Hours

I am free to meet anytime! I am happy to meet in person at 66-263 or through zoom at my personal zoom link: https://mit.zoom.us/my/davidkastner. Let me know if you would like to talk about the class lessons or if you have a personal project that you would like help with.

kastner@mit.edu

https://github.com/davidkastner/3DScience

www.3dscience.org