

Day: Jan 25, 2023

Time: 10:30 – 11:30AM

Room: 56-154

Lecture 3: Scientific Animations and Movies Notes

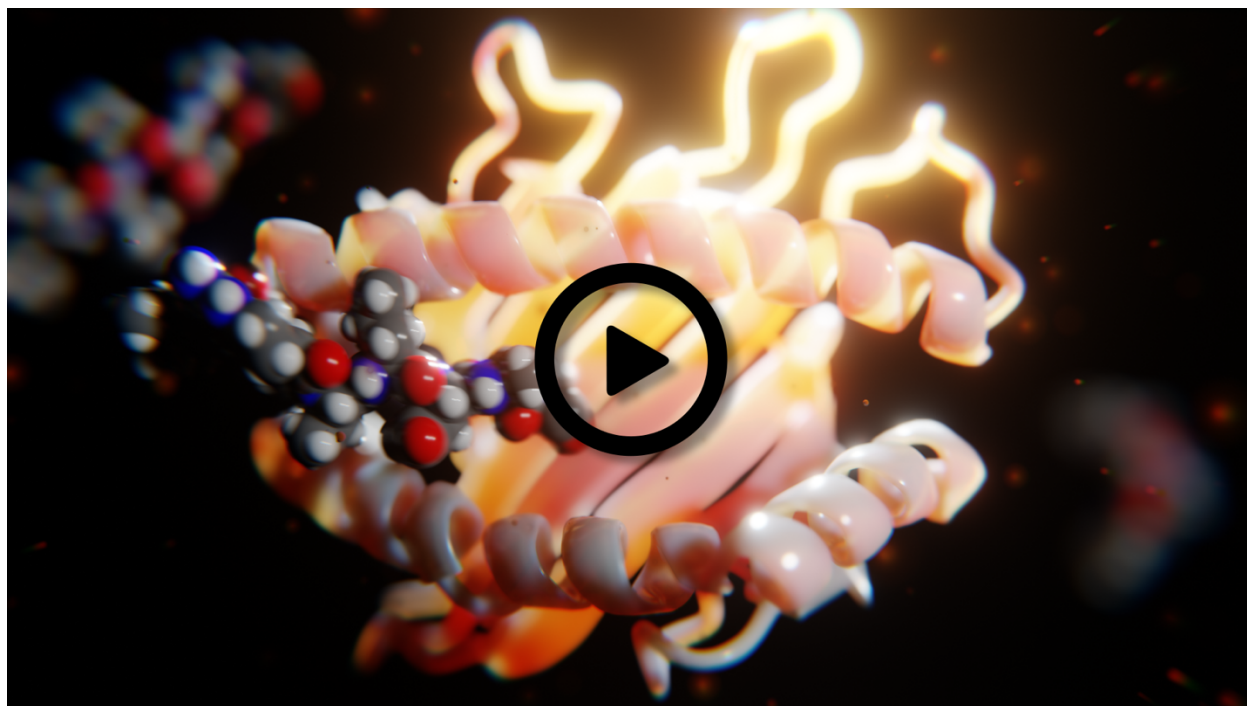


Figure 1. The result of this lesson will be a movie of the peptide ligand entering and leaving the MHC binding pocket.

Lesson Summary

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.

Class Schedule

1. Animating a ligand binding	15min
2. Creating a looping animation effect	10 min
3. Creating predictable dust particles that appear random	15 min
4. Rendering and processing an animation in Blender	10 min
Total Time	55 min

1. Animating a ligand binding (15 min)

We are ready to begin animating. We are going to create a simple animation of the ligand binding to the MHC.

1. Select the peptide and combine all the atoms into a single object we can manipulate
 - a. Select an atom somewhere in the middle of the peptide
 - b. **Outliner** → **Peptide** → **Right-click Atoms** → Select **Objects** → **Right-click** the selected atoms in the **3D Window** → **Parent** → **Object**
 - c. Now if we move that one atom in the middle of the peptide, all of the atoms will move
2. Expand the timeline
3. In the **Timeline Window**, change the **End** value to **150**
 - a. This represents the total number of frames of our render
4. Move the timeline cursor to frame **75**
 - a. Go to the **Sidebar** and **Right-click Location values** → **Insert keyframes**
 - b. Repeat on rotation
5. This will ensure that the peptide is perfectly bound to the MHC at the middle of the animation
6. Move the timeline cursor back to frame 1
7. Move the peptide off to somewhere to the right using **Move**
8. Insert new keyframes at **Location** and **Rotation** with **Right-click Insert Keyframes**
9. Play the animation and see what you think
10. This is the fun part of animation and why it is hard
11. You can now add new **Locations** and **Rotations** at different keyframes to make it more natural. This can be as simple or as complex as you want it to be

2. Creating a looping animation effect (10 min)

In some cases, the goal for an animation or video is to showcase it on social media. In that case, the most effective type of animations is looping animations as it gives the illusion that your video is much longer and required more time than it did. In this section we are going to animate peptide completely leaving the screen in a way that allows for the animation to be looped.

- Go to frame **150** in the **Timeline Window**
- Select the **Peptide**
 - You can either select your central atom that you used as the parent or you can go to the **Outliner** and **Right-click** on **Peptide** → Select **Objects**
- Move the peptide out of the screen on the left side
 - Anywhere is fine but I just a position closer to the upper left rather than the lower left, which would add some interesting twisting
- Now run the animation
- Go to the frame when the peptide begins leaving the MHC binding site
 - Move the molecule slightly upward as if it is going “over” the helix

- Insert new keyframes at **Location** and **Rotation** with **Right-click Insert Keyframes**
- Add as many keyframes as you like

3. Creating predictable dust particles that appear random (15 min)

A small amount of dust is one of the best elements that you can add to your scene to improve the depth and atmosphere of your renders. However, dust usually moves randomly, which won't work in this scene since we are hoping to be able to loop the animation. This means we will need dust that is in the same place at the beginning and ends of the video but seems to move randomly in between.

- Create an **Icosphere**
 - **Shift+A → Mesh → Icosphere**
 - Scale it up so that it contains the whole scene including the camera
 - All the dust particles will be generated within this object
- Add a circle
 - **Shift+A → Curve → Nurbs Circle**
 - Scale it up so that it completely surrounds the icosphere
- Create an Empty
 - **Shift+A → Empty → Plain Axes**
- Create a new **Icosphere** and scale it down
 - This will be the reference dust particle
- Create a new **Collection** called **Dust**
 - Move the three objects in **Collection**
 - **Hint: Right-click** them in the **3D Window** → Move to **Collection** → **Dust**
- Rename each of the objects
 - Circle renamed to **Dust Path**
 - Large icosphere renamed to **Dust Container**
 - Small icosphere renamed to **Dust**
 - Empty renamed to **Dust Controller**
- Click on the **Dust Controller**
 - Go to **Object Constraint Properties** in the **Properties Window**
- Check **Motion Blur** in the **Render Properties** tab of the **Properties Window**
 - Add **Object Constraint → Follow Path**
 - **Influence = 0.02**
 - Click on the eye dropper and then click on the **Dust Path** in the **3D Window**
 - The **Dust Controller** should snap to Dust Path
 - Go to frame 1 in the **Timeline Window**
 - Right click **Offset** in the Object Constraint Properties
 - Keep the value as **0.00**
 - **Right-click → Insert Keyframe**
 - Go to frame **151** in the **Timeline Window**
 - **Right-click** Offset (0.00) in the Object Constraint Properties
 - Change the value to **100**

- **Right-click → Insert keyframe**
- Click on the **Dust Container**
 - Add a **Displace** modifier
 - **Modifier Properties** in the **Properties Window** → **Add Modifier** → **Displace** → **New**
 - **Strength = 0.1**
 - **Object** → **Eye dropper** → **Dust Controller**
 - With the Dust Container still selected, switch to the Texture Properties tab
 - **Type** → **Stucci**
 - **Size = 1.75**
- We will now create a particle simulation
 - Click on Dust Container
 - Go to the Particle Properties tab in the Properties Window
 - Select Hair
 - Select Advanced
 - **Render** → **Path** → **Object** → eye dropper → select Dust in the 3D Window
 - **Emission** → **Source** → Change Faces to Volume
 - **Render** → Uncheck Show Emitter
 - **Viewport Display** → Uncheck Show Emitter
 - This will hide the Dust Container
 - Change the size of the particles
 - **Render** → **Scale** = 0.3
 - **Render** → **Scale Randomness** = 1.0
- Change the color of **Dust** to a reddish hue
 - Go to the **Material Properties** tab in the **Properties Window**
 - **Base Color** = **C15C05**

4. Rendering and processing an animation in Blender (10 min)

Now that the scene is finished, we can render it out. The render will take a while to finish depending on the number of frames. Once the still frames finish rendering, we can compile them into a final .mp4 right here in Blender. No need for external software.

- Render the Animation
 - **Render** → **Render Animation**
 - This will take around 30 min with a decent computer
- After the rendering is complete
- Go to the Output Properties tab in the Properties Window
 - **Output** → **File** → Desktop
 - This just tells Blender to save your files in some place other than some cryptic temp folder
 - **Output** → **File Format** → **FFmpeg Video**
 - **Encoding** → **Video** → **Output Quality** → **High Quality**
 - **Encoding** → **Container** → **MPEG-4**
- Click **Add** in the **Header** bar

- **Image/Sequence**
- Navigate to the folder with your frames
 - Select all the frames
 - Change **End Frame** to **150**
- Select Video Sequencer from within the Editor Selector
- You will see a tan bar which represents the new animation
- Now you can render the frames out together as a video
 - **Render → Render animation**
 - It will finish in less than a minute
- Congratulations of your first movie!