A Guide on Modelling Synapses in CellBlender and MCell

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Abstract

# 1 Pre- and Postsynaptic Genomtry with Blender

This section follows the paper written by Czech et. al. closely.

1.1 Creating a Spine Head

1. Open Blender. In the '3D View' pane, delete the default object (shortcut: x)

2. Create a sphere. Select the 'UV Sphere' option from the sidebar. Below a pane called 'Add Circle' appears; set 'Segments' and 'Rings' to 16, 'Radius to '0.25'.

3. Rename the sphere. Double-click the entry box below to change the default name to 'SpineHead'.
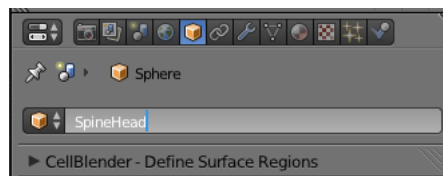

4. Change view to see the sphere from the 'Front' view. (shortcut: 1 on numpad)

5. Deselect the sphere (shortcut: a) and make it transparent (shortcut: z)

6. Select the vertices to be removed. First, switch from 'Object Mode' to 'Edit Mode'. Ensure that 'Edge select' is enabled. Then use box select (shortcut: b) to capture only the faces that make up the top half of the sphere. Delete these faces (shortcut: x) and select the 'Faces' option in the delete menu.

7. Close the opening. Select the topmost vertices (remaining in 'Edge select' mode) using box select (shortcut: b). Then, extrude (shortcut: e) and click 'Edges Only' under 'Extrude' in 'Mesh Tools'.

Set the extrude distance by pressing 0 and Enter to confirm. Scale the extrusion by pressing s, 0 and Enter to confirm. Select 'Remove Doubles' under 'Mesh Tools' to remove the duplicated vertices and reconnect the triangles. Blender should note that you remove 15 vertices as a result.
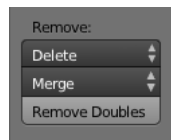

The object should now be closed by a flat top.

8. Subdivide triangles at the top. Unfortunately the 'Multicut tool' has been deprecated. To create set of concentric rings, first select the topmost vertices (shortcut: b). Then enter 'Knife' mode (shortcut: k), and hold down *control*. This locks the knife cut to the midpoint. Click around to make a circle cut, and then press *Enter* to complete the cut. Continue these cuts until the picture looks as below:
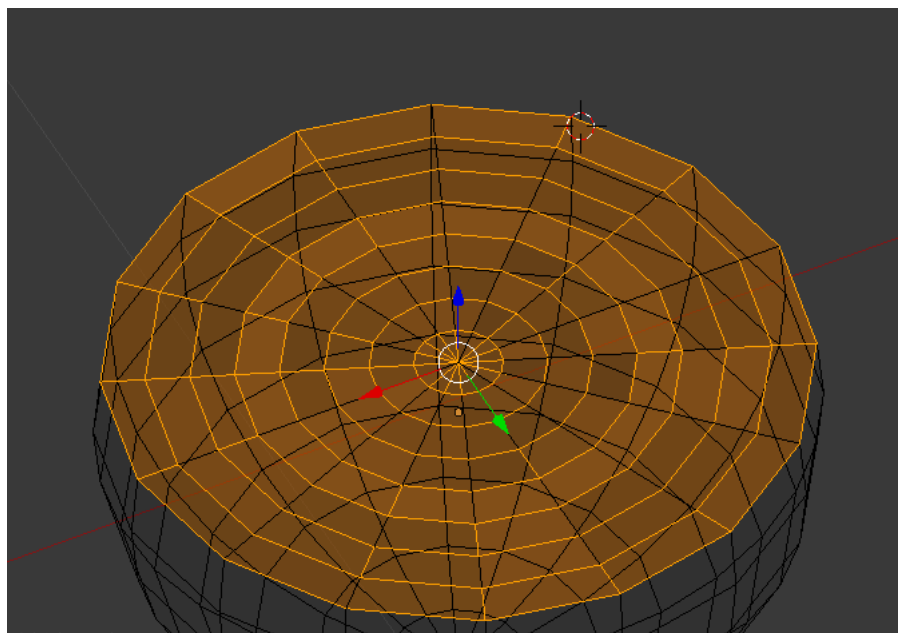
1.2 Creating a presynaptic bouton

1. Duplicate the *spine.blend* file as *bouton.blend*. in *bouton.blend* deselect all (shortcut: a).

2. Duplicate the spine head and rotate. First, switch to 'Front' view (shortcut: 1 on numpad). Duplicate (shortcut: Shift-d, Enter) and rotate 180 degrees (shortcut: r, 180, Enter). To separate the selection of the spine heads, press p and click 'Selection'.

3. Rename the item. Switch to 'Object Mode' (shortcut: Tab) and edit the name field to 'PresynapticBouton'.
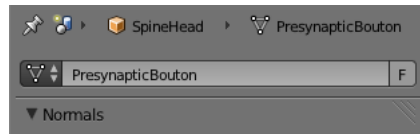
4. Grab the object (shortcut: g), constrain movement to the z-axis (shortcut: z) and type 0.15, *Enter* to move the object. Scale the object to be 20% larger by typing s, 1.2, *Enter*.