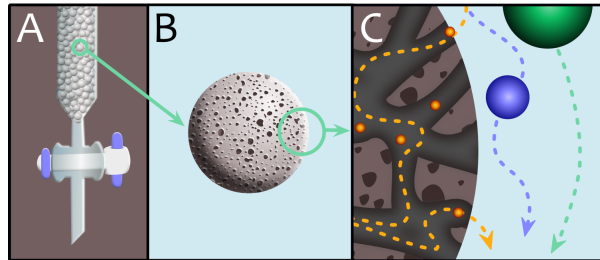


Creating Digital Illustrations for Your Research

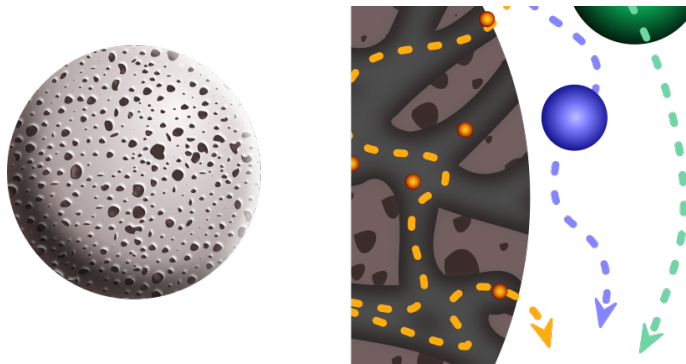
Workshop IV – Illustration Demo Part II

Final Figure

Principles of Size Exclusion Chromatography



Workshop IV Components



Topics & Techniques covered

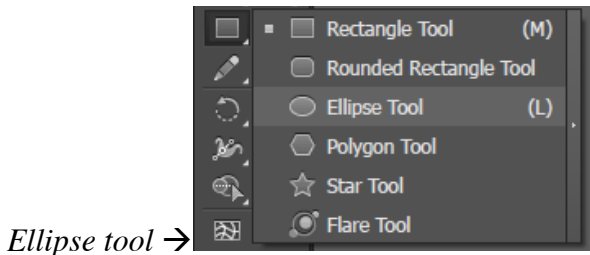
- How to randomly transform a group of individual shapes.
- How to distort paths using the warp, bloat, and pucker tools.
- How to combine shapes into a single object.
- How to distort the stroke width.
- How to transform a stroke into a shape of its own.
- How to simplify the path of a shape.
- How to create an offset path.
- How to change the stroke type.

Panel B

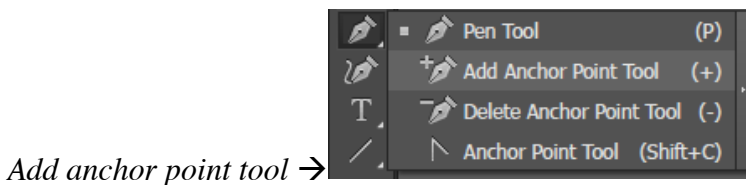
In this session of the workshop we will create the components from panels B and C. We will start with the textured bead, the focus of panel B.

Modifying standard shapes

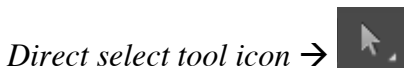
1. First create a circle using the ellipse tool (remember – the ellipse tool is one of the options in the rectangle tool menu).



2. Make a copy of the circle and then add a few random anchor points to the copy by clicking anywhere on the path with the add anchor point version of the pen tool.



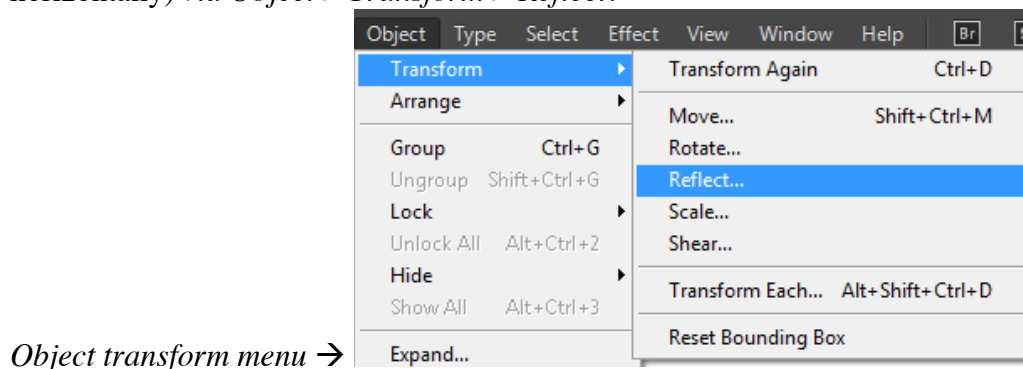
3. Now use the direct select tool to adjust the anchor points and their handles until you have a semi-circular, imperfect shape.



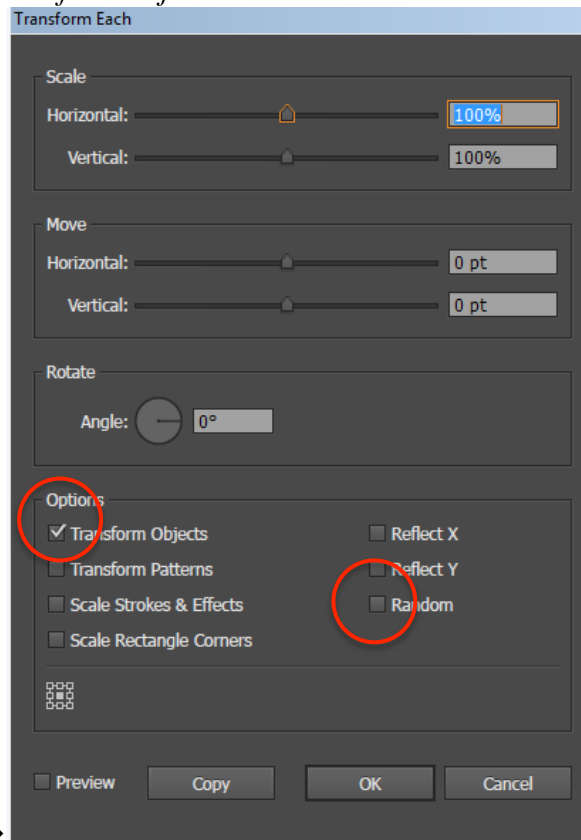
4. Repeat steps 2 and 3 a few times to make a variety of circular shapes. You can also draw some odd shapes from scratch using the pen tool if you like.

Randomizing shape size and orientation

5. Now that we have a few basic shapes to begin with, we will use these to generate a random assortment of pores.
6. Select all of the circular objects you created. Duplicate the objects by holding down *alt* and then *left-clicking and dragging* them to one side.
7. Scale your first set of duplicates to be either larger or smaller than the original pores.
8. Now duplicate the pore shapes again and reflect these duplicates (either vertically or horizontally) via *Object > Transform > Reflect*.



- Once you have a variety of shapes, we will randomize them even further using the transform each operation. Select all of the pore shapes and then go to *Object > Transform > Transform Each*.
- First make sure that the *transform objects* and *random* boxes are checked.

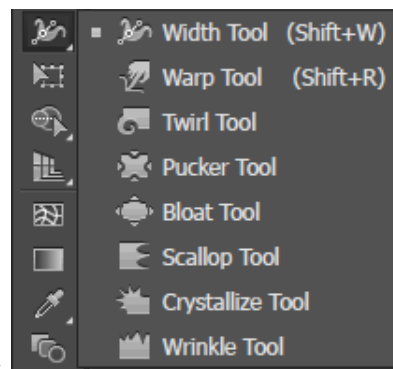


Transform each menu →

- Next change the values of scale, rotate, and move to randomly alter your pores.

Randomly distorting shapes

- If you'd like to add more variety to the pores you can distort them further using the liquify tools. The liquify tool menu has 8 different options. Select the warp tool to begin with.



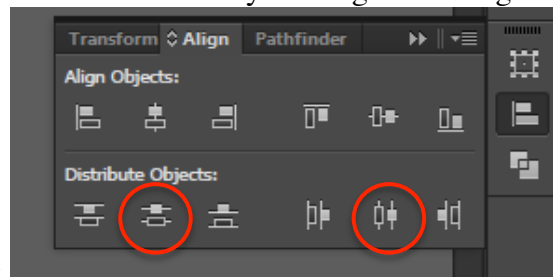
Liquify tool menu →

- After selecting the warp tool, the brush size will appear as a circle on the screen. Hold down *alt* and then left-click and drag to change the brush size and shape.

14. Drag the brush across objects to directionally warp them. The bloat and pucker options also work well for pore deformation.
15. Test out different types of distortion until you are satisfied with the resulting pore distribution.

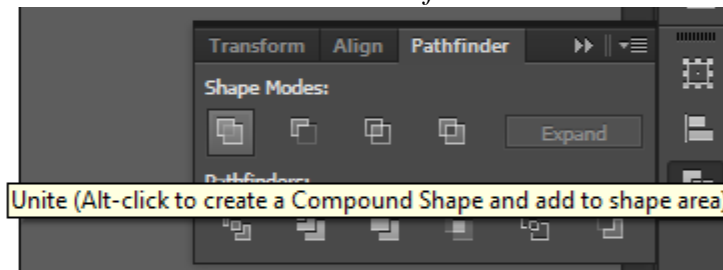
Uniting many paths into one complex path

16. Once you are satisfied with the assortment, move one of the pores to the top right and bottom left corner of the page.
17. Open the align menu with *Window > Align*. Then select all of the pores and click distribute horizontally and then distribute vertically. This should give you a pretty good spread. Finalize the distribution by moving or resizing some of the pores.



Align menu →

18. Now group the pores together with *ctrl + g* and make a copy of the group.
19. Select the individual pores in one of the groups by double left-clicking on the group.
20. Open the pathfinder menu with *Window > Pathfinder* and then click the unite icon.



Unite icon →

21. Uniting the pores formed an object that we can now use to make holes in the surface of the bead. First create a copy of the pore object. Then create a circle using the ellipse tool. Create a copy of the circle and set it aside.
22. Overlap the circle and the pore object and then use the *exclude overlapping areas* option in the pathfinder menu to cut holes into the circle. Don't worry about any weird shapes that appear outside of the circle at this point. We will clip those out later.




Exclude icon →

23. Create a copy of the newly formed bead surface and set it aside for now.

Using an object's stroke as shading

24. Next make another copy of the pore object. Remove the fill from one copy and give this copy a black stroke.
25. Open the stroke menu and change the width of the stroke to give the shape a thick outline.

Stroke menu icon → 

26. Now we can blur the stroke in the same way we did last session – *Effect > Blur > Gaussian blur*.
27. Line up the shadow with the pore cutouts in the shape you made earlier. Move the shadow behind the bead surface so that each pore appears shaded.
28. Make another copy of the circle you set aside earlier. Give one circle a light brown fill. Line up this circle with the cutout and shadow and then move it to the back.
29. Finalize this step of the shading by giving the bead’s surface a radial gradient fill like we did for the small bead we made last session.

Global object shading

30. Now we want to give the bead and its pores shading overall. Make two more copies of the same circle. Fill each copy with a different bright color.
31. Use the method we learned last session to create a shadow and highlight object for the circle.
 - a. Briefly: Overlap the two circles. Move the top circle up and to the right slightly to leave a “shadow” shape exposed on the bottom of the circle.
 - b. Next make a copy of the two circles and move the top circle to the back in one of the copies.
 - c. Use the pathfinder menu to subtract the front circle from the back circle in each pair. Color the shadow black and the highlight white.
32. Place the black shape on the bottom edge of the bead and the white shape on the top edge of the bead. Blur both shapes to give them a gradient shading effect.
33. Group all of the bead’s layers together. Place another copy of the circle on top of the group and clip the edges with *Object > Clipping mask > Make*.
34. The close-up bead is now complete!

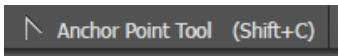
Panel C

In panel C we have a few different components. The first component is the cross section of the bead with pore channels. We also have diffusing molecules (which are just variants of the gradient sphere we made earlier), and the arrow trails.

35. First let’s start with the bead cut out. Take the copy of the bead surface with pores that you set aside earlier and color it light brown.
36. Make a dark brown ellipse in the background as well.

Creating lines with the pen tool

37. Next we will make the channels. Using the pen tool create a line with about 5-10 anchor points. End the line without closing the shape by holding *ctrl* and *left-clicking* in an area free from objects.
38. Change the anchor points from corners to curves using the convert anchor point version of the pen tool.

Convert anchor point tool → 

39. Now make a copy of the line and distort it. Create a few more copies and adjust the anchor points of each line to make them all different.
40. Use *Object > Transform each* to randomize the orientations and sizes of the channels.

41. Group the channels together and set aside a copy just in case because the next steps will be destructive.

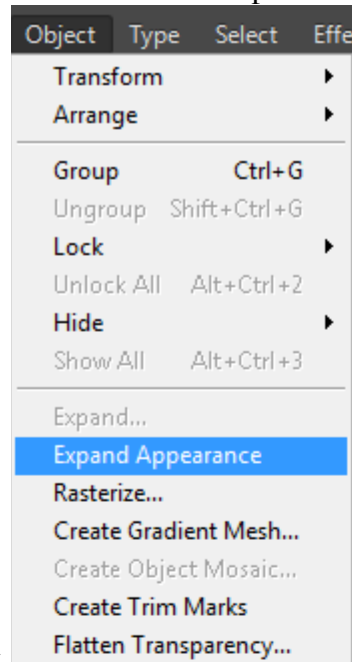
Distorting stroke width and converting strokes to paths

42. Now select the channels and choose the width distort tool from the liquify tool menu.

Width distort tool →  Width Tool (Shift+W)

43. Use this tool to alter the width of the channels randomly by dragging it across the lines.

44. Now convert the stroke of each line into a path with *Object > Expand appearance*.

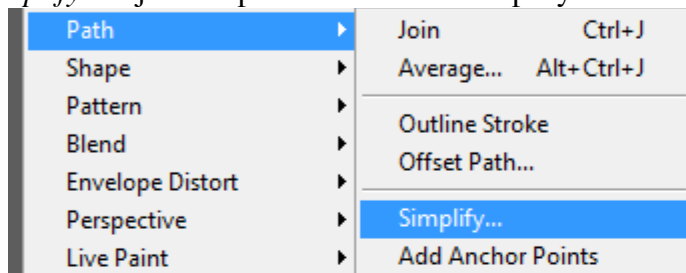


Expand appearance →

45. Once we have converted the lines to paths we can combine them. First make sure that you finalize the arrangement of the channels. Don't worry about making the entire area perfect, just creating one usable piece to crop out. Then use the pathfinder menu to combine the shapes with the unite option.

Creating shaded channels with offset path

46. In order to make the channels look a little bit more natural simplify the shape with *Object > Path > Simplify*. Adjust the parameters in the simplify menu to your liking.



Simplify →

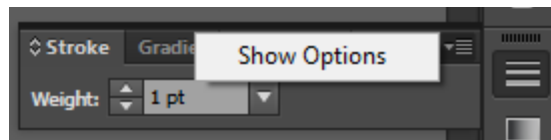
47. Create a copy of the channel network. Make an offset path with *Object > Path > Offset path*. Adjust the offset width to yield a reasonable outline of the channels.

48. Color the original channels light brown and blur them with *Object > Effect > Blur > Gaussian Blur*.

49. Place the blurred channels on top of the offset channel shape. This should give an appearance of shading. Group the two channel objects together.
50. Now stack the channels on top of the holey sphere and background you made earlier and group them.
51. Crop out the edges with a circular clipping mask (*Object > Clipping Mask > Make*). The bead's cross section is now complete!

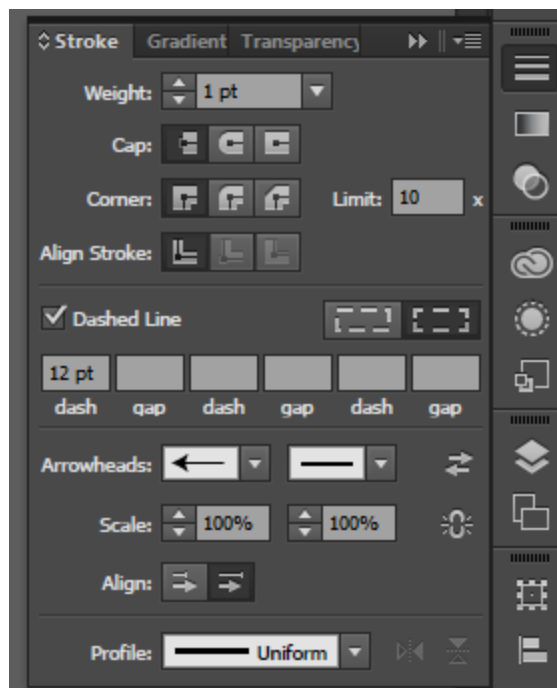
Creating a dashed stroke

52. Finish the panel with a few diffusing objects and their trajectories. First create a couple different colors of gradient spheres to represent diffusing molecules.
53. Next we will use the pen tool to draw trails. Make a trajectory with several curved anchor points for each molecule.
54. Adjust the color of each trail to match the appropriate molecule using the eyedropper tool.
55. Now select the trails and open the stroke menu. Reveal more stroke options by left-clicking on the small square menu in the upper right hand corner and selecting *> Show options*.



Show options →

56. Now use the advanced menu to change the stroke type from solid to dashed. You can also use this menu to add an arrowhead on end of the each trail.



Advanced stroke menu →

All of the components you need to construct the final graphic are now finished. From this point forward you can simply use techniques we've already learned to arrange and finalize the figure! I have included a version of the column we illustrated last time as a hidden layer in the document, if you'd like to put all the pieces together.