Getting started with Illustrator

Illustrator can seem intimidating at first but it helps to get familiar with its main tools.

The **Adobe illustrator user guide** is a brilliant place to start.

For scientific figures, knowing how to use the pen, gradient, align, text and brush tools is particularly important.

The aim of this guide is to provide helpful resources for scientific illustration and give specific examples where these tools are applied.

To make figure making more efficient it's good to keep some keyboard shortcuts in mind (most shortcuts shown below):

Adobe Illustrator CC

Keyboard shortcuts for macOS

Scan the QR code to access the complete list of Illustrator keyboard shortcuts:

The following list includes some helpful shortcuts for Illustrator CC.

Tool	Shortcut
Selection	V
Direct Selection	A
Magic Wand	Y
Lasso	Q
Pen	P
Curvature Tool	Shift + ~
Type	T
Touch Type	Shift + T
Line Segment	\
Anchor Point	Shift + C
Add Anchor Point	=
Delete Anchor Point	-
Rectangle	M
Ellipse	L
Paintbrush	B
Blob Brush	Shift + B
Pencil	N
Shaper Tool	Shift + N
Scissors	C
Rotate	R
Reflect	O
Free Transform	E
Perspective Grid	Shift + P
Perspective Selection	Shift + V
Warp	Shift + R
Width	Shift + W
Eraser	Shift + E
Mesh	U
Gradient	G
Eyedropper	I
Blend	W
Scale	S
Column Graph	J
Shape Builder	Shift + M
Live Paint Bucket	K
Live Paint Selection	Shift + L
Artboard	Shift + O
Slice	Shift + K
Hand	H
Zoom	Z
Color	,
Gradient	.
Default	D
None	/
Toggle Fill/Stroke	X
Swap Fill/Stroke	Shift + X
Symbol Sprayer	Shift + S
Toggle Screen Mode	F

Action	Shortcut
Create a document	Command + N
Create a document from a template	Shift + Command + N
Open a document	Ctrl + O
Place a file in the document	Shift + Command + P
Open the Export for screens dialog box	Option + Command + E
Open the Save For Web dialog box	Option+Shift+Command+S
Package the document	Option+Shift+Command+P
Open the File Information dialog box	Option+Shift+Command+I
Print	Command + P
Exit the application	Command + Q
Open the Color Settings dialog box	Shift + Command + K
Open the Preferences dialog box	Command + K
Repeat transforming objects in perspective	Command + D
Move an object	Shift + Command + M
Group the selected artwork	Command + G
Ungroup the selected artwork	Shift + Command + G
Make a clipping mask	Command + 7
Select artwork in active artboard	Command + Option + A
Deselect	Shift + Command + A
Reselect	Command + 6
Select the object above the current selection	Option + Command +]
Select the object below the current selection	Option + Command + [
Make Live Paint (when using the Paint Bucket tool)	Option + Command + X
Zoom in	Command + =
Zoom out	Command + -
View all artboards in window	Command + 0 (zero)
Show/ hide artboard rulers	Command + R
Show/ hide smart guides	Command + U
Show grid	Command + '
Show/ hide Align panel	Shift + F7
Show/ hide Appearance panel	Shift + F6
Show/ hide Color panel	F6
Show/ hide Gradient panel	Command + F9
Show/ hide Graphic Styles panel	Shift + F5
Show/ hide Info panel	Command + F8
Show/ hide Layers panel	F7
Show/ hide Stroke panel	Command + F10
Show/ hide Symbols panel	Shift + Command + F11
Open the Character panel	Command + T
Open the Paragraph panel	Option + Command + T
Show/ hide Transform panel	Shift + F8
Show/ hide Pathfinder panel	Shift + Command + F9
Add new fill	Command + /
Add new stroke	Command + Option
Add a layer	Command + L
Add a layer while opening the New Layer dialog box	Option + Command + L

https://helpx.adobe.com/illustrator/user-guide.html

Useful video tutorials

The Complete Beginners Guide To Adobe Illustrator, a 19 part series (by Gareth David Studio)

Adobe Illustrator for Scientists, a 10 part series (by Kevin Bonham)

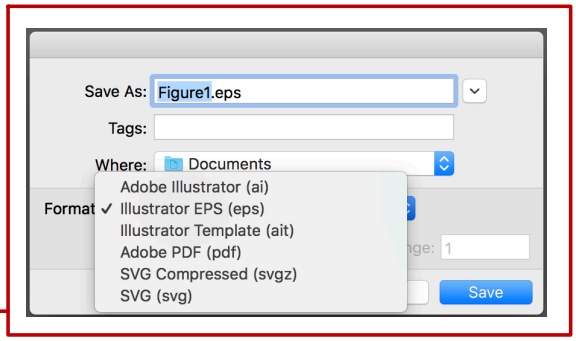
Adobe Illustrator Tutorials, choose one of 218 videos [more general audience] by Dansky.

Adobe Illustrator and file formats

Make sure to always save a copy of your file in the adobe illustrator format (.ai). This file format will allow edits to be made to the figure if needed and will save the data in vector format (plus bitmap if pictures have been inserted).

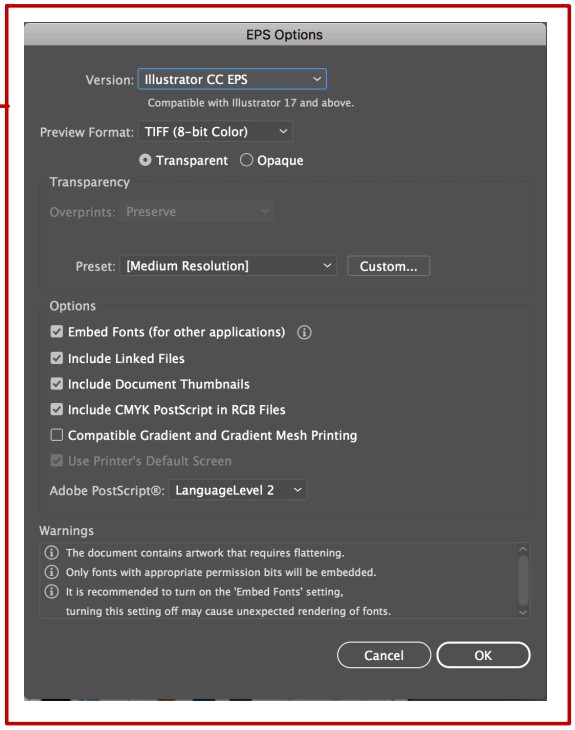
However, for journal submission you may also require to save the figure in EPS or tiff. This section shows how this is done. *(Based on a tutorial by David Bacon, The Crick institute)*

1. Go to File>Save As then choose Illustrator EPS.



2. In the new dialogue that opens ensure the following are ticked:

   - ☑ Embed Fonts (to display fonts correctly)
   - ☑ Documents Thumbnails (for easy viewing)
   - ☑ CMYK Poscript in RGB files (enables colour management)

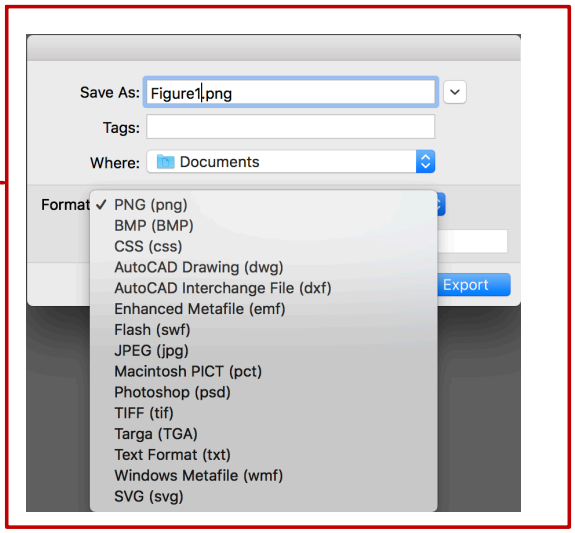


Alongside the .ai and .eps files, you can create a export a file format (e.g. tiff, jpeg and png) for easier handling.

N.B. both JPEG and PNG files undergo heavy data compression (and data loss). The advantage is that they are much smaller (e.g. 3.2 MB compared to a tiff of the same figure at 41.7 MB). For these purposes they are more suitable for e-mail attachments and insertion into a Word document than for submission to a journal.

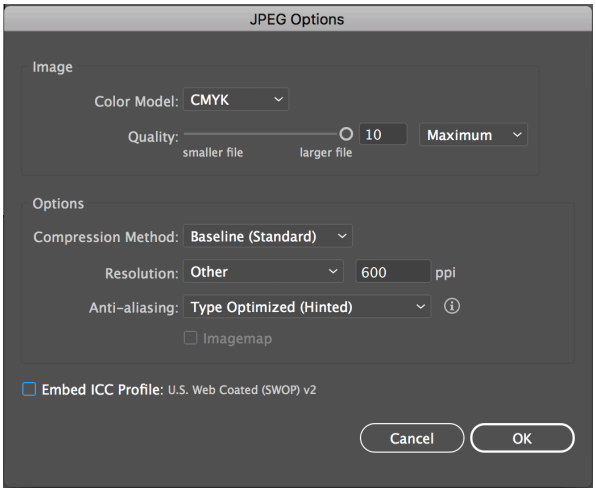
For journals export figure as TIFF (output at 600 dpi).

1. Go to File>Export>Export as.. and then choose the format of choice.

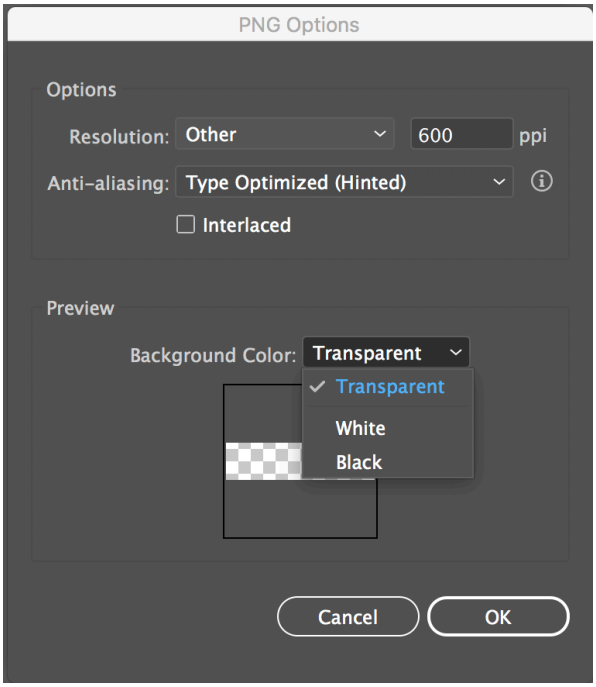


2. Change the settings as required for by the journal, but in general the following is recommended:

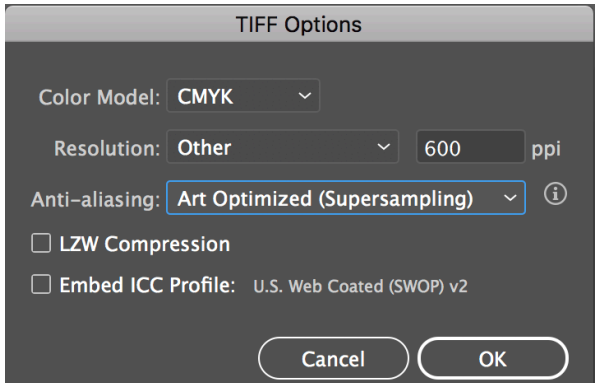
JPEG



PNG



TIFF

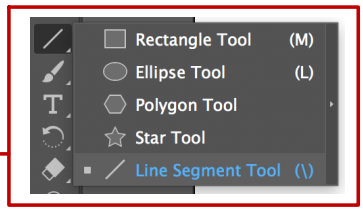


Using and modifying the line segment tool

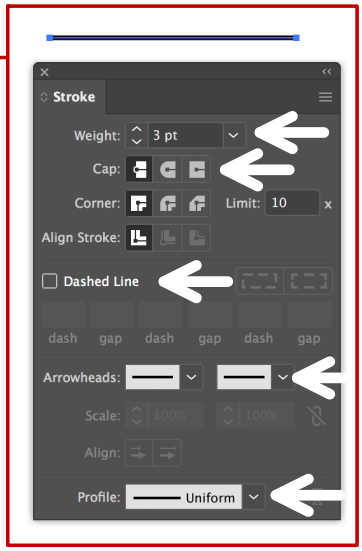
You can easily make a line in Illustrator and convert it to an arrow, a zig-zag line and even a wave. There are also many ways to style a line (give it a rounded tip and various different profiles). This tutorial will cover some of these features.

The basic features

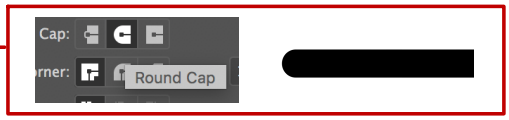
1. Select the **Line segment tool**, click once on the document and in the dialogue that opens specify 60 mm length (and angle at 0º). Click OK.



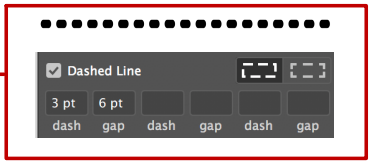
2. Ensure the strokes panel is visible *Window> Strokes….* and change the **Weight** of the line to 3 pt. White arrow heads on the screenshot shown on the right indicates the 5 features that this tutorial will use.



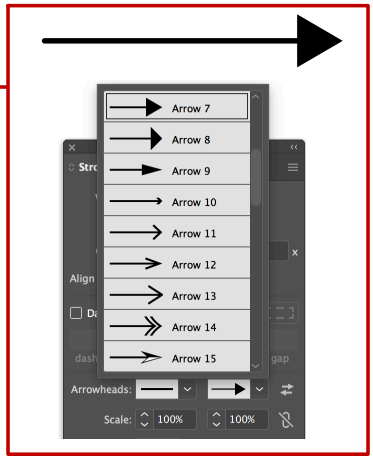
3. Next, you can change the **Cap** of the line to a rounded edge (Middle icon from the Cap options). The end of your line should now look like this (zoomed in).



4. If you want to **Dash** your line then you can tick that option and give it a 3 pt dash 3 pt gap spacing, but for the rest of the tutorial we will untick that option.

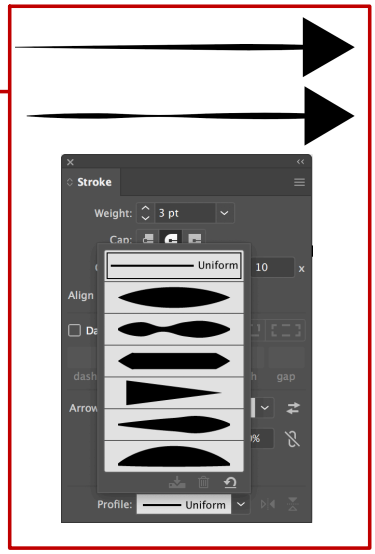


5. Go to the **Arrowheads** region in the Strokes panel. Choose your favourite arrowhead and whether you want it on the left or right side (or both). Scale the arrowheads to make them smaller if you wish.



6. Finally, we will explore the **Profile** option. Choose your favourite profile and see how it changes the style of your line. A couple of examples are shown.

N.B. Steps 2-6 can be applied to any shape with a stroke, not just a line.

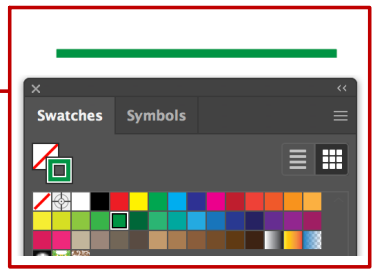


Giving the line a stroke

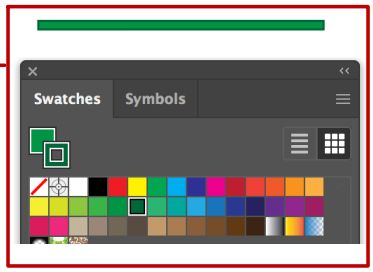
Sometimes a line needs a stroke to highlight it from the background. To demonstrate this here, we will first make a new line (repeat step 1 of **The Basic Features** tutorial).

1. Change the weight of the line in the Strokes panel to 5 pt.

2. Select the line and give it a colour, e.g. green (*Window>Swatches* and choose a green). Select the hollow square (shown on the upper left part of the Swatches panel) to change the colour for a stroke.



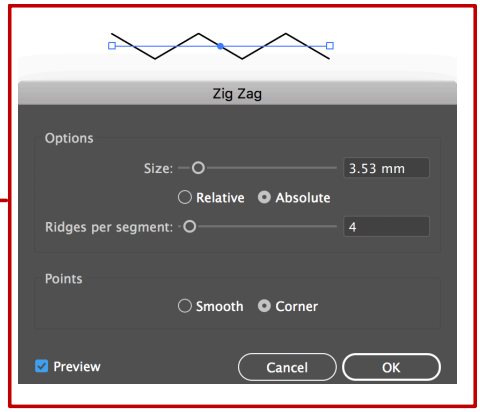
3. Now that your line is expanded, the previous green colour you applied becomes the fill (indicated in the full square on the upper left part of the Swatches panel). Select the hollow square on the Swatches panel to select a darker green colour. This should now frame your line and make it stand out a bit more.



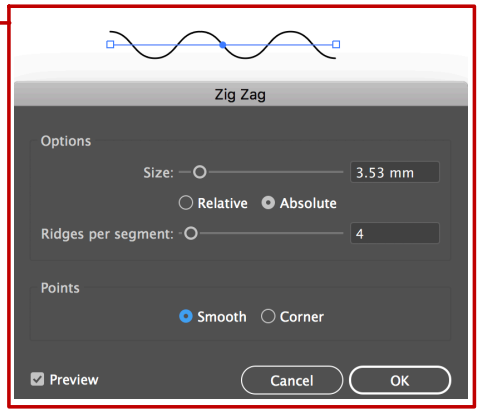
Stylising a straight line

A straight line can be completely transformed in Illustrator. To demonstrate this, first repeat step 1 of **The Basic Features** tutorial.

1. Select the line then go to *Effect> Distort&Transform>Zig Zag…* Try out the shown parameters.

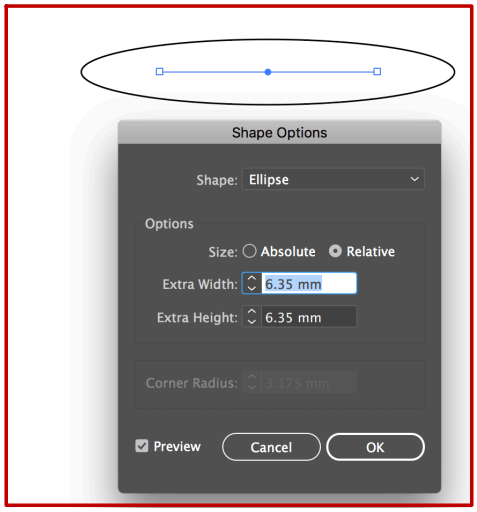


2. Alternatively, tick the Smooth option to turn the line into a wave.



3. Click Cancel for now in the Zig Zag dialogue as we will try another option. Go to *Effect> Convert to Shape>Ellipse…* to turn the line into a circle that can be modified in many different ways.

N.B. After each modification of the line make sure to expand it (*Object>Expand Appearance* and then *Object>Expand*) to treat it as a new shape.

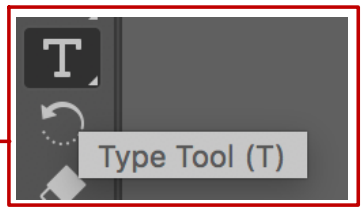


Using the type tool and modifying text

Scientific figures almost always require annotation and the Type tool is extremely versatile for this use. This tutorial will cover simple annotation, text boxes and typing on curved lines (for stylistic reasons). As with any of these tools, it's advised to read the journal requirements before proceeding.

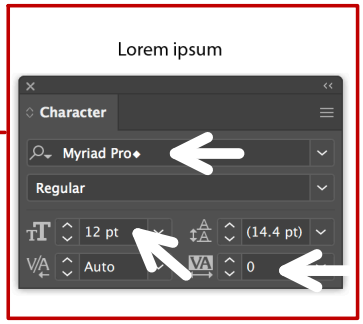
The basic features

1. Select the **Type** tool from the main toolbar (if invisible go to *Window>Toolbars>Basic*).

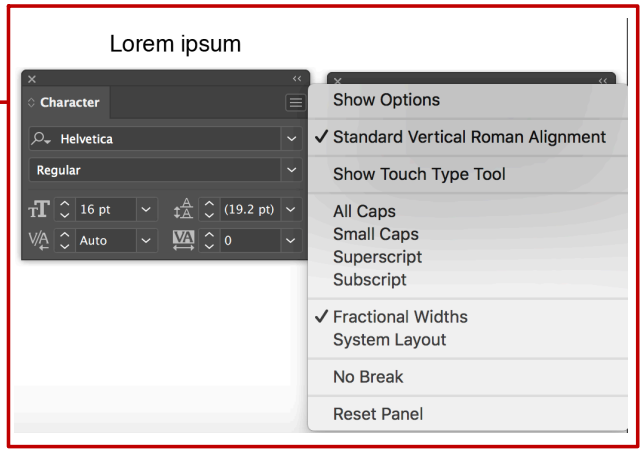


2. Ensure the **Character** panel is open (*Window>Type*) then click anywhere on the document. A pre-typed phrase comes up. Select this phrase and change the Font, size and spacing if required (white arrows indicate where these parameters can be changed).

Alternatively, click and drag on the document to create a text box where you can contain text within certain dimensions.

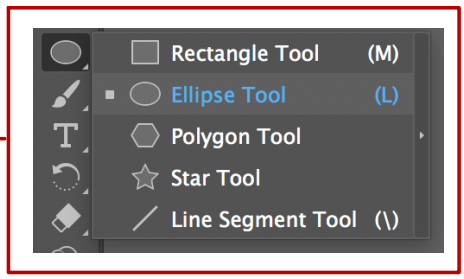


3. In this case I have chosen Helvetica, 16 pt and left the character spacing unchanged. In the sub-menu (upper right hand corner), text can be changed to different casing and converted to superscript, subscript etc, which is often useful for scientific annotation.

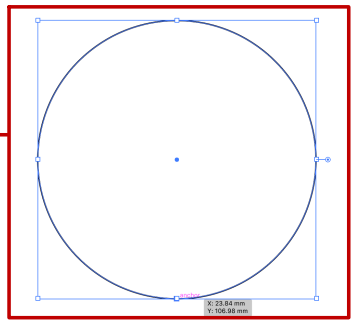


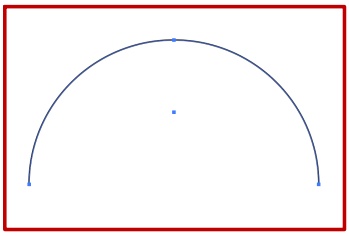
4. Next, we will try typing on a curved line. First select the **Ellipse** Tool option from the Tool bar.

Click anywhere on the document and in the dialogue that opens, specify 40x40 mm dimensions, then click OK.

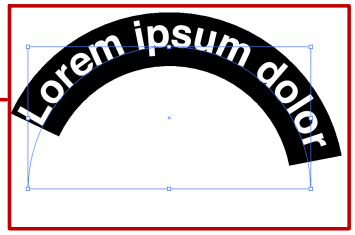


5. Select the **Direct selection** tool from the tool bar and select the bottom anchor point of the circle. Hit backspace on your keyboard. It should now look like a semi circle.





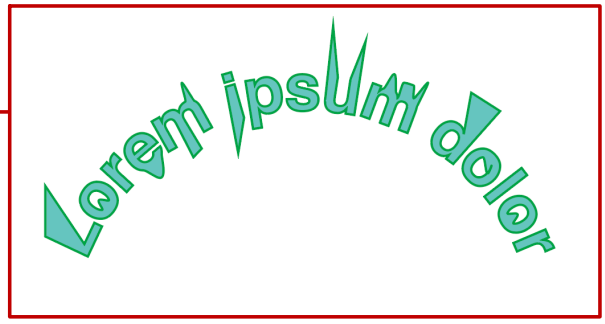
6. Select the **Type** tool again (Shown in Step 1) and hover over the semi circle. A type cursor with a curved line should come up. Click on the line when this appears. This will allow you to type anything following that curved path.



7. To treat your text as a modifiable shape, do the following: from the **Character** panel, choose the Bold font (from the drop down menu below the Font type). Then go to *Object>Expand* and leave everything default in the dialogue that opens.

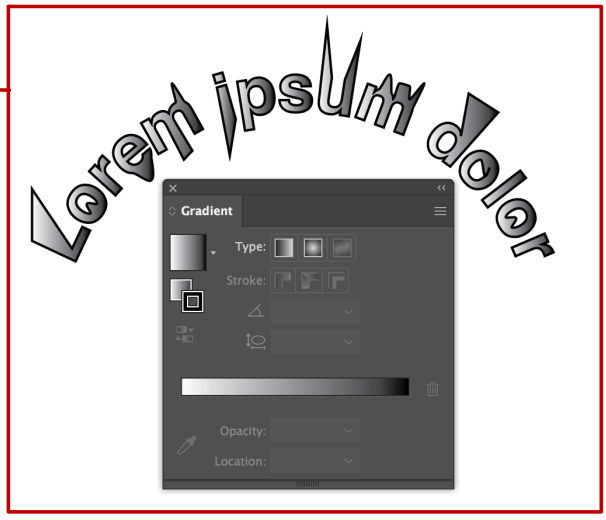
8. Select this shape and give it a fill and a stroke of your choice.

9. Each letter is a new shape and can be modified using individual anchor points. Using the **Direct Selection** tool from the tool bar (white arrow), zoom in and start modifying individual fonts. This could be useful if you're making a logo or just want to stylise the text. Here I'm showing an extreme example to illustrate the point.



10. You can also add gradients to this fill and stroke of this text a la old school Word Art. Select all the letters and then click on the **Gradient** tool from the toolbar. If Gradient panel is invisible go to *Window>Gradient*.

Select the Fill icon and change it to the black and white gradient. Then chose the stroke icon and change it to black. It should look something like this.



Using fill and shape effects to create a signalling pathway

"A *mesh object* is a multicoloured object on which colours can flow in different directions and transition smoothly from one point to another. When you create a mesh object, multiple lines called *mesh lines* crisscross the object and provide a way to easily manipulate colour transitions on the object. By moving and editing points on the mesh lines, you can change the intensity of a colour shift, or change the extent of a coloured area on the object." /Adobe Illustrator definition

In this tutorial, we will make shapes that can be used for signalling pathways. We will try two different effects for the fill: gradient mesh and layering of transparent shapes.

Using warped shapes and gradient mesh

1. To depict a protein, we will make a ***warped*** circle:

a. Select the **Ellipse** tool and click once on the document.

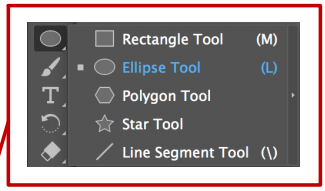
b. In the dialogue that opens type 30x30 mm

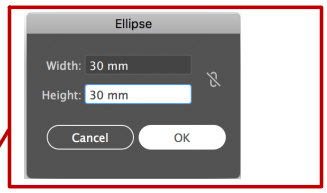
c. Select the circle and go to *Effect> Warp>Arc…* and use the shown parameters, then click OK.

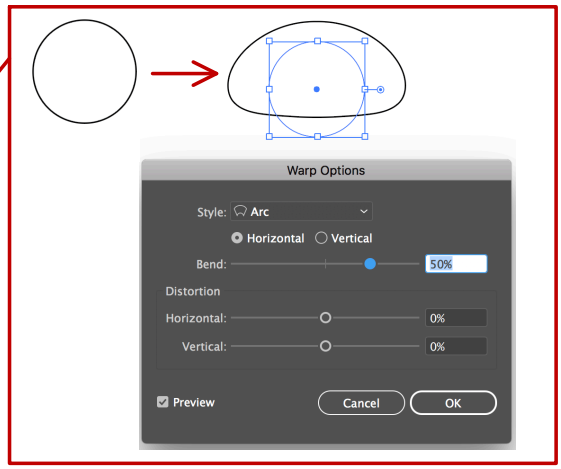
d. Go to *Object>Expand Appearance* to treat this as a new shape that can be edited

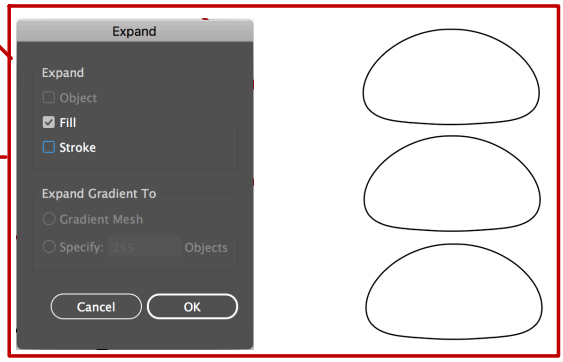
e. With the shape still selected go to *Object>Expand*. **Deselect** stroke then click OK in the dialogue that opens.

f. Make two copies of this new shape (alt + drag or ctrl/cmd+c and ctrl/cmd+v). The first copy will be used to create a stroke for the gradient mesh shape and the second copy will be used for the "layering" fill effect.

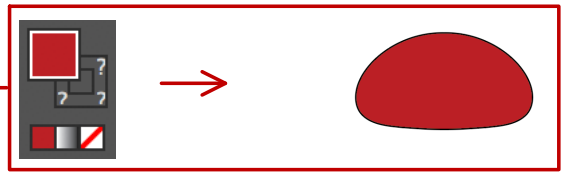




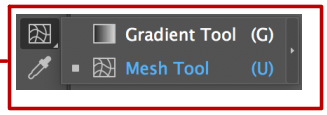




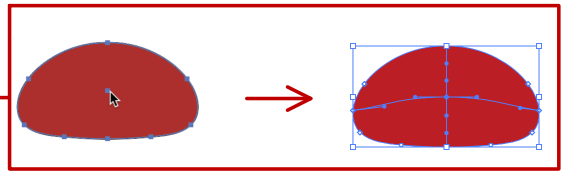
2. Select the top shape and then give it a fill colour, e.g. a red such as BC0000.



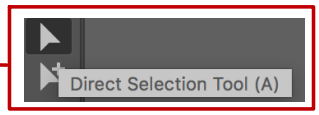
3. With the shape selected, go to the Main toolbar and select the ***Mesh Tool***.



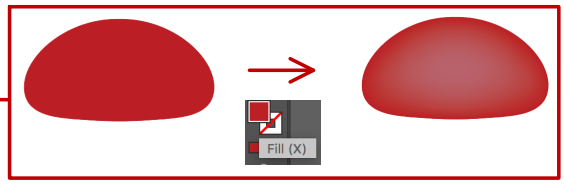
4. Click on the middle point (a cursor with a small plus sign shows up). This will create a simple mesh. If you want to create a more complex mesh you can click along the middle blue lines.



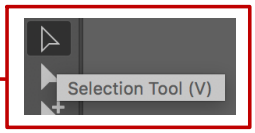
5. Select the *Direct selection tool* from the main toolbar. Select the middle point of the gradient mesh again.



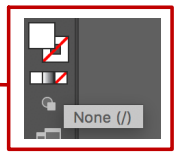
6. Double click the colour picker and choose a lighter colour, e.g. B7636D. This will create a subtle but visually pleasing gradient in the shape.



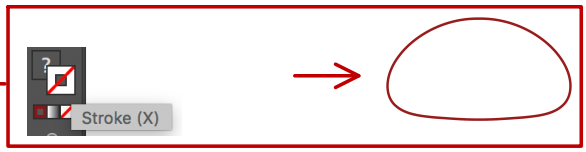
7. The Gradient mesh tool removes the strokes from the shapes so the first copy of the shape that was created earlier will now be used to restore the stroke:



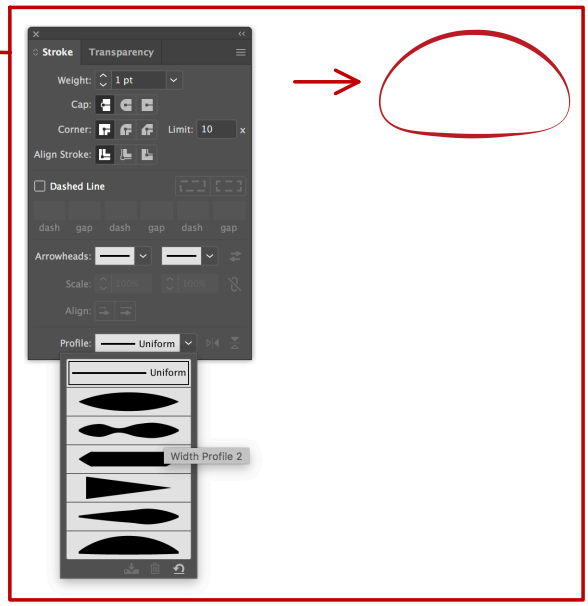
a. Using the black selection tool, click on the second copy of the shape. Ensure it has no fill (in the colour picker toolbar click on the square with the red diagonal).



b. With the shape still selected double click on the stroke colour picker and choose a darker red colour (e.g. 990202)



c. Next the stroke will be given a new "profile':

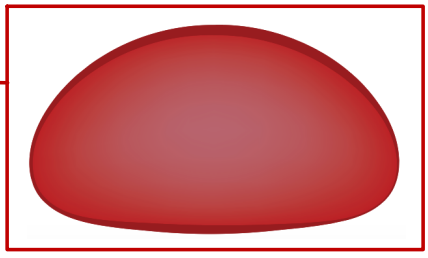


- Click on the stroke panel (if the panel is invisible go to *Window>Stroke*)
- With the shape selected choose Width Profile 2 then select Weight 4 pt in the upper part of the panel.
- Your stroke should look something like the screenshot.

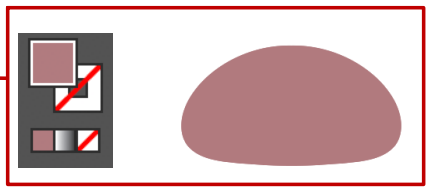
Place the stroke shape on top of the gradient fill shape. Once positioned, right click on the gradient shape and go to Arrange>Send to back.

Select both the stroke and gradient shapes and group them (right click then click Group).

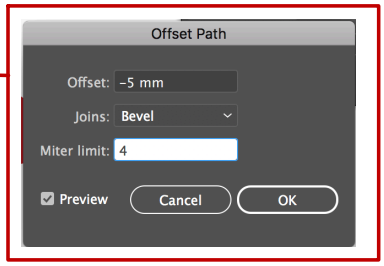
It should look as shown.



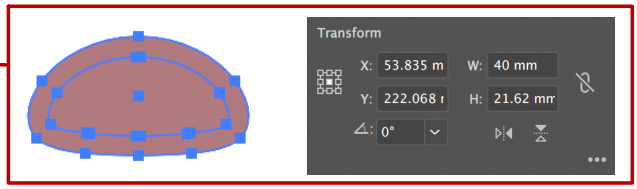
8. (Optional) To add more lighting effects, we will use the second copy made in step 1f. Select this second copy and give it a transparent stroke and light red/pink fill (e.g. AF797D).



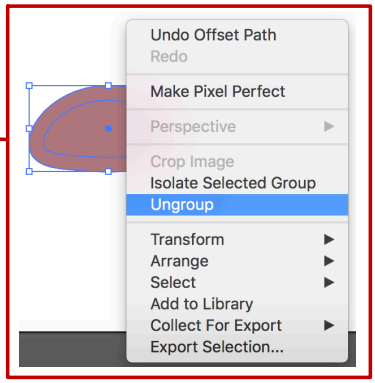
9. With this copy selected, go to *Object>Path> Offset Path* and in the dialogue that opens enter the shown parameters. Click OK.



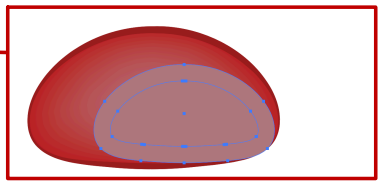
10. Make the resulting shapes a bit smaller, e.g. according to the dimensions shown:



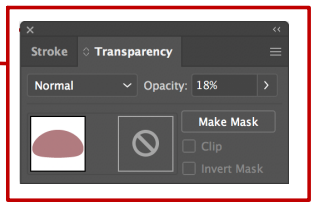
11. Right click on the shape and click on ungroup.



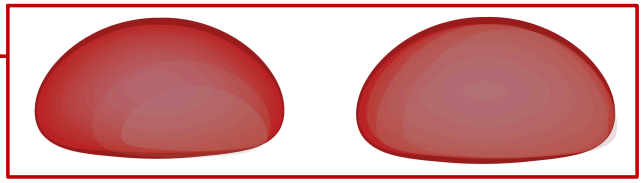
12. Drag over these two shapes over the gradient fill shape.



Select the bottom pink shape and in the transparency tool bar (*Window> Transparency*) and select 18%. Select the top pink shape and make it 36% transparent.



Shape should look something like this -- move around the layering shapes, copy and resize them as desired to create a 3D lighting effect.

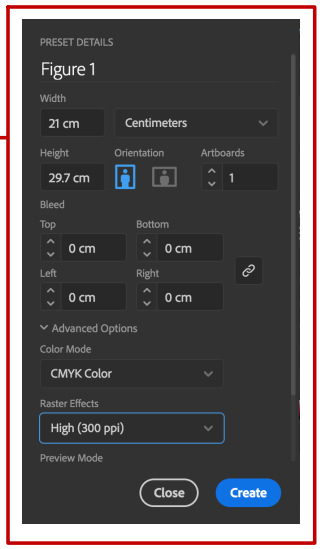


Annotating a bit-map figure

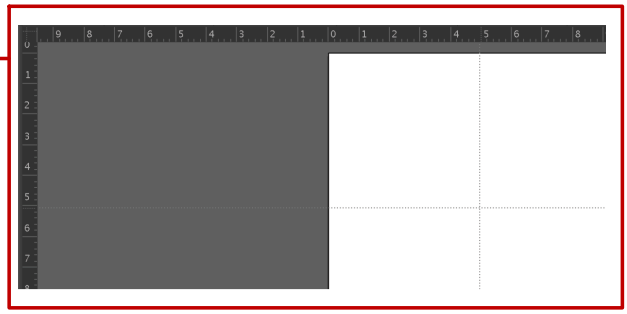
This section will detail how to annotate and align text for a bitmap figure. This technique was originally taught by David Bacon (The Francis Crick Institute) and this tutorial is adapted from his instructions.

Preparing to place figures

1. Go to File>New.
In the dialogue that opens select A4 and change the units to centimetres and ensure the orientation is Portrait.



2. Go to View>Rulers>Show Rulers.
Drag the Point of origin in until it is 5 cm from the top and left edge of the page.

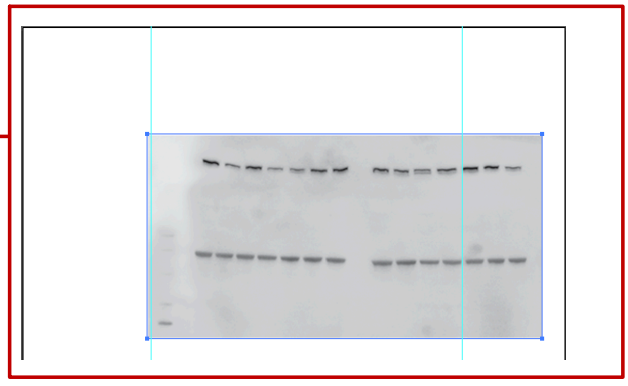


3. Click on the vertical ruler and drag vertical guidelines (they show up as cyan/blue lines) to 0 cm and 12 cm.

Placing and aligning figure panels

4. Go to File>Place. Locate the image (in this case an example blot from this source is used). Make sure the Link button is not checked.

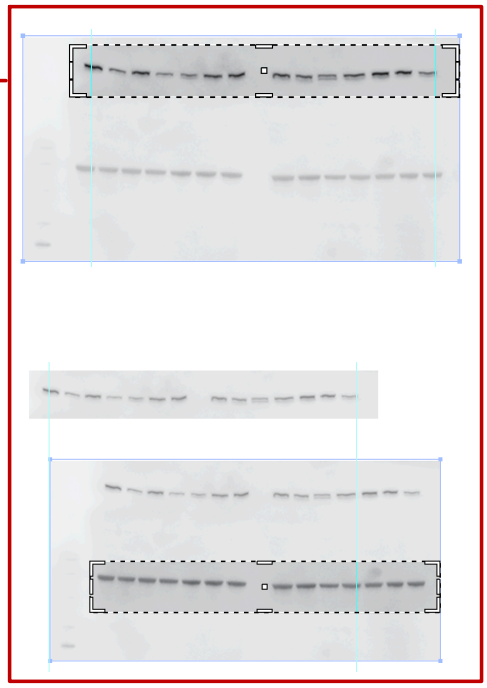
Click Place.



5. In this case we need to crop the blot to separate the sample and loading control rows (make sure a raw copy of the blot is saved elsewhere for display in Supplementary figures).

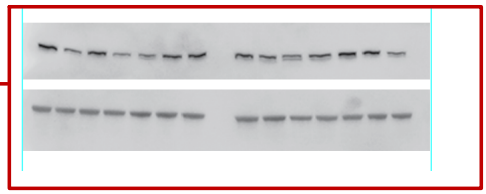
Copy and paste the blot. Go to Object> Crop image and adjust the highlighted box to fit around the bands. Click Apply once happy with the fit.

Repeat this for the lower row on the copied blot.

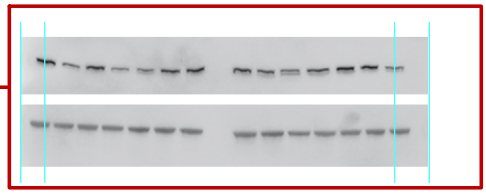


6. With the blots still active, drag them to align with the left Guideline at the vertical 0 position.

Shift and drag one corner to size the blot within the two cyan lines.

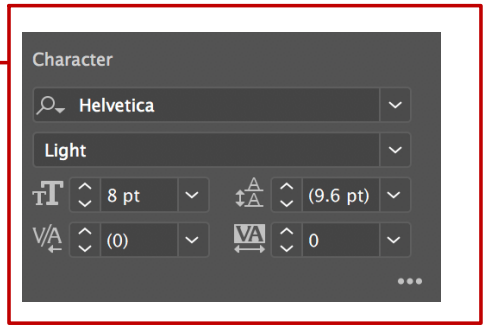


7. Drag one vertical guideline to the centre of lane1, row 1 and one to the centre of the last lane, row 1.



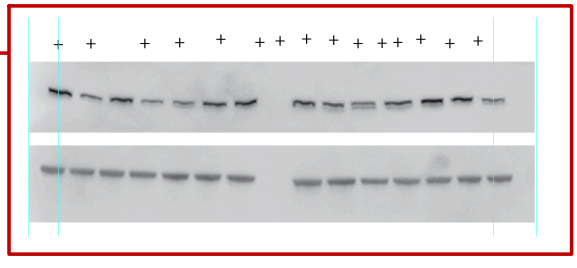
8. Select the Type tool from the main tool bar and click on the document above lane 1, then type '+'.

Change the font (to suit journal requirements) in the Type toolbar that comes up.

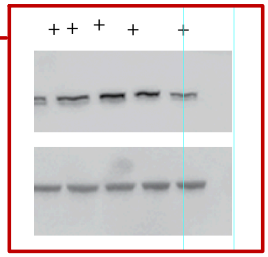


9. Select the '+' and copy and paste this 14 more times (one for each lane shown). This can be done through cmd+c and cmd+v or click, 'Alt' then drag.

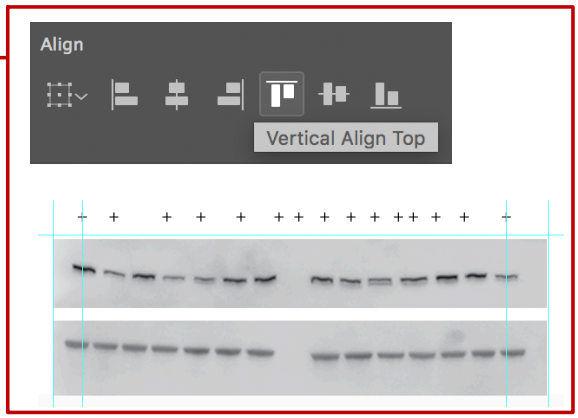
Change the font in the Type toolbar that comes up.



10. Align the last '+' text box manually against the right guideline.



11. Select all the other '+' to make them active, then use the 'vertical align top' from the Align toolbar.



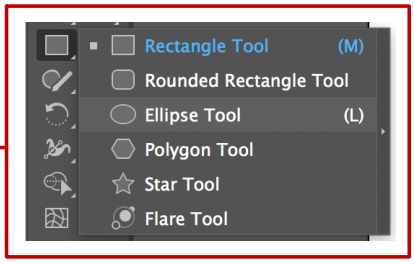
12. Next, choose Horizontal Distribute Left. Finally, delete the middle '+' where there is no band.

Making a phospholipid bilayer using brushes

Brushes can be used to add effects and/or shapes to existing paths. Here we want to apply multiple phospholipid copies to a curved line to give the impression of a curved membrane. Brushes allow us to this very quickly and we can re-use this brush for other shapes, for example a circle to depict an endosome.

Stage 1: Make the phospholipid head

1. Select the **Ellipse tool** from the tool bar to start creating the phospholipid head (if hidden go to Window>Toolbars> Advanced)

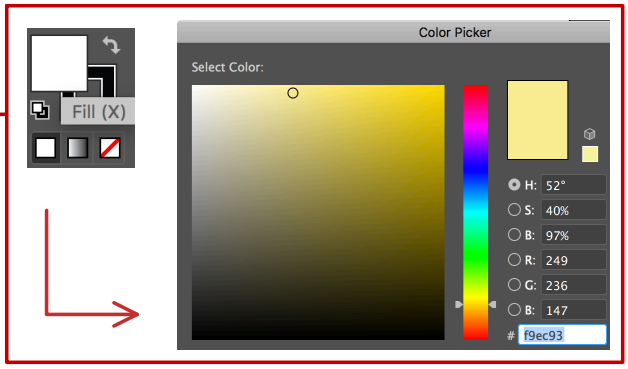


2. Click anywhere on the artboard document and enter the parameters shown. Click OK.

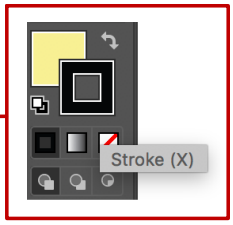
Alternatively, click and drag on the document while holding shift key down to create a concentric circle.

3. Double click the **Fill (X)** icon (white square, located at the bottom of the tool bar) and choose a light yellow colour from the colour picker (e.g. f9ec93)

N.B. For this to work as a brush later on only solid fills can be used (gradient mesh etc. not compatible)

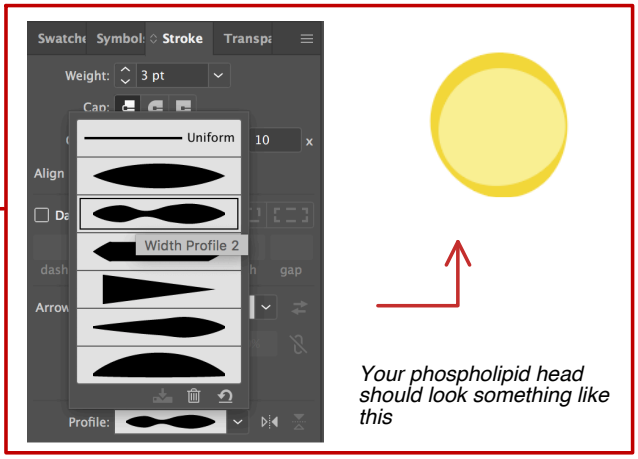


4. Double click the **Stroke** icon (black frame, located at the bottom of the tool bar) and choose a dark yellow colour from the colour picker (e.g. f2d738).



5. Give the stroke a bit more definition by changing the weight to 3pt and selecting width profile 2 (optional).

If this toolbar is not visible go to Window>Strokes to view it.

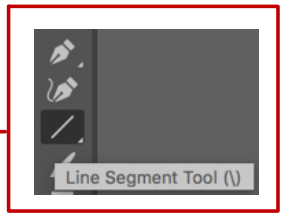


Your phospholipid head should look something like this

Stage 2: Make the phospholipid tails

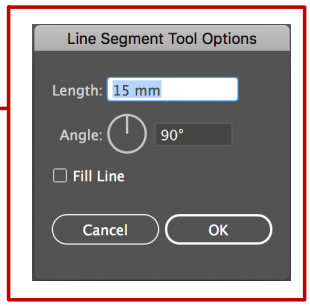
There are several ways to do draw a curved line (e.g. pen tool, arc tool etc), but the easiest is to stylise a straight line.

1. Select the **Line segment tool** from the main tool bar.



2. Click once on the document then write down the desired line length (15 mm), angle (90º) and untick 'fill line' then click OK.

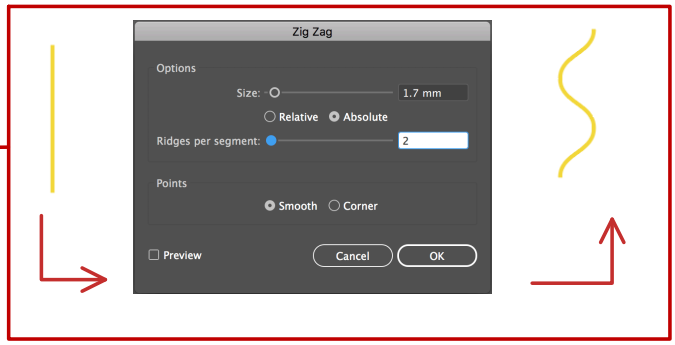
Alternatively, click and drag on the document (while holding down shift) to draw a straight, vertical line.



3. Select the line then click *Effect>Distort>ZigZag*…

a. In the dialogue that opens, enter 1.7 mm size, 2 ridges per segment and choose smooth points.

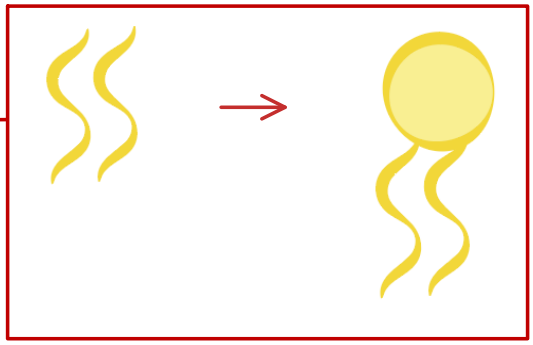
b. Select your new curved line and go to *Object>Expand Appearance*



4. Select the curved line then change weight of stroke to 3pt and width profile 2 (to match the stroke of the phospholipid head).

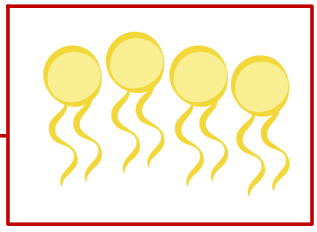
Copy the line (cmd+c then cmd+v, or click, hold down alt and drag).

Select the two curved lines and position below the phospholipid head. Select all objects and group them (cmd+g or right click, group).



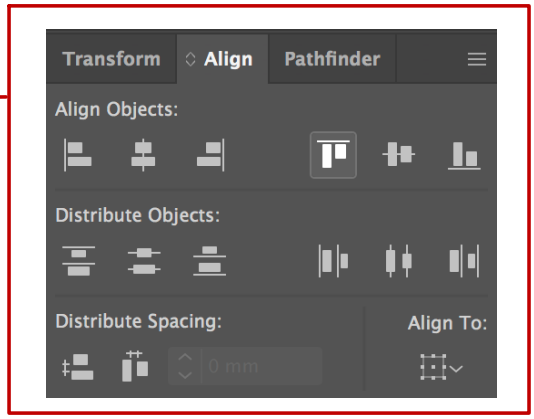
Stage 3: Make a phospholipid brush

1. Copy the phospholipid three more times and arrange roughly. Group all.



2. Select the 4 phospholipids and align so that all heads are arranged neatly: if not already open click *Window>Align.*

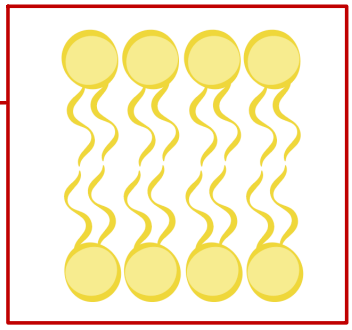
   Copy the group of four phospholipids and click on this copy. Then *Object> Transform>Rotate…* and in the dialogue enter 180º.



3. Arrange the bottom layer underneath the now aligned top layer as shown.

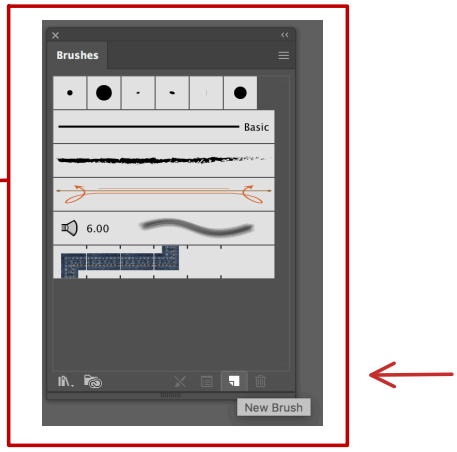
   Select all these phospholipids and group them.

   N.B. Make sure that the left and right edges match each other, otherwise there will be a gap in your brush pattern.

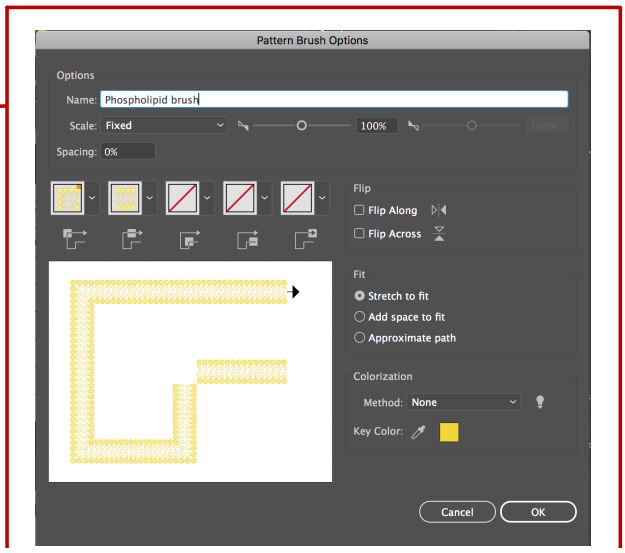


4. View the **Brushes** toolbar if not already visible *Window>Brushes*. Select your grouped phospholipids and drag them to the "new icon" in the bottom right hand corner of the Brushes toolbar.

   In the new dialogue that appears, choose Pattern brush, then click OK.



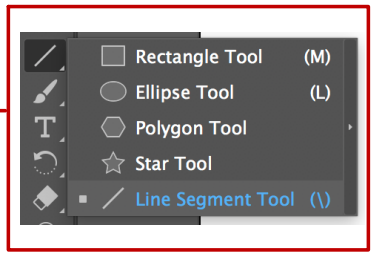
5. In the pattern brush window that appears, call the brush "Phospholipid brush" and change scale to 50%.



Creating a DNA brush

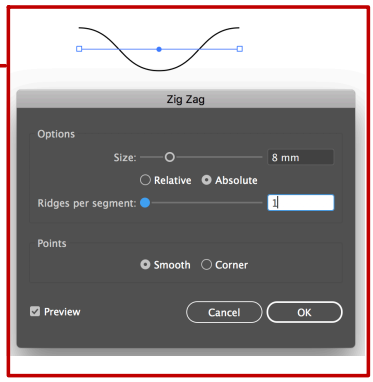
DNA drawings are a staple of a scientist's illustrator arsenal. This brush can be used for a wide variety of figures, including CRISPR-Cas9 diagrams and depictions of mutations.

1. Select the **Line segment tool**, click once on the document and in the dialogue that opens specify 60 mm length (and angle at 0º). Click OK.



2. Select the line then go to *Effects> Distort&Transform>Zig Zag…*. In the dialogue that opens, enter the shown parameters, then click OK.

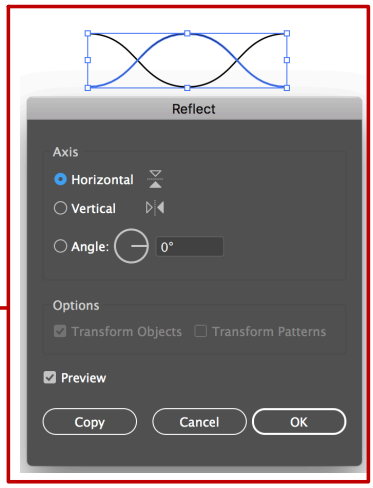
Go to *Window>Stroke* and change the weight to 3 pt.



3. Select the now curved line then go to brown circle and go to Select the two shapes and go to *Object>Expand Appearance*. And again *Object>Expand* (in the dialogue that opens click OK).

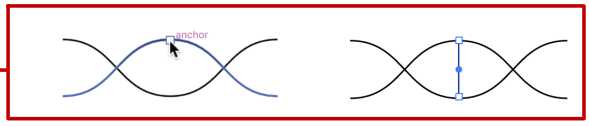
4. Go to *Edit>Copy* then *Edit>Paste in Place*.

5. Go to *Object>Tranform>Reflect...* And select Horizontal. Click OK.

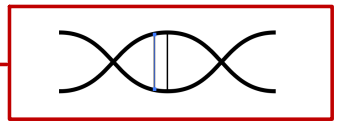


6. Go to *View>Smart Guides* (make sure it is ticked). This will help with the alignment of the base pairs in the subsequent steps.

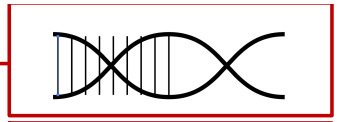
7. Select the Line segment tool and hover over the midpoint of the DNA backbone. The anchor signs comes up. There press shift and drag across to create a line as shown.



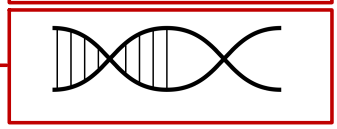
8. Click the middle line, then press alt and shift then drag the line -3.6 mm to copy it evenly as shown.



9. Click that second line then press Cmd/Ctrl+D to copy it evenly across the DNA backbone.

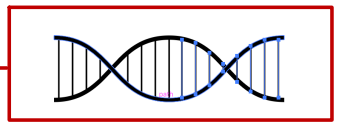


10. With the direct selection tool, bring in the edges of the line so they come in with the DNA backbone.

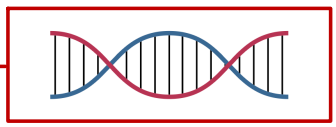


11. Select all lines (shift + select) apart from the middle one with the selection tool (black arrow), then *Edit>Copy* and *Edit>Paste in Place*. Go to *Object>Transform>Reflect…* then select **Vertical** under Axis.

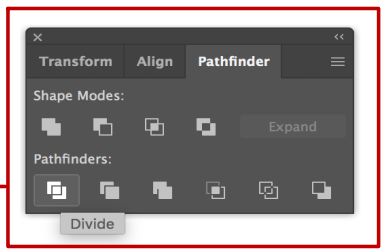
Drag this newly transformed selection across to fit the rest of the backbone.



12. Colour one of the strands red and the other blue. Finally, right click on each stroke and select *Arrange>Bring to Front*. It should look something like this.



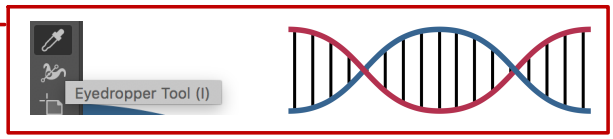
13. To give the appearance of right-handed DNA, the Pathfinder tool will be used (*Window>Pathfinder*) to weave the strands under and over each other.



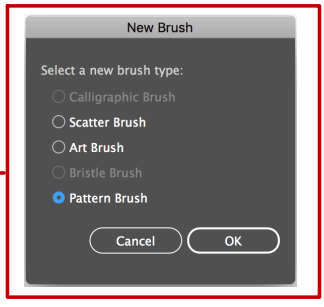
a. Select both strands then select the **Divide** Pathfinder option.

b. Zoom in (Cmd+) and double click the right junction where two strands meet (a little diamond-shaped selection shows up)

c. Using the eye dropper tool click anywhere on the red strand. The selected bit will now turn that same colour and now we have the effect of the red strand going over the blue strand in that region.



14. Make a brush out of this DNA drawing:

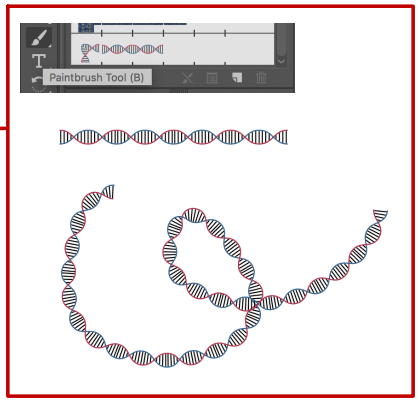


a. Select all and right click, then click Group. Make the DNA a bit smaller.

b. Ensure **Brushes** toolbar is open (*Window>Brushes*). Drag the DNA onto the Brushes toolbar. In the dialogue that opens choose **Pattern Brush**.

c. In the new dialogue name the brush DNA and leave everything as default. Click OK.

15. With the paint brush tool and DNA brush selected draw any shape on the document and the brush should follow it.

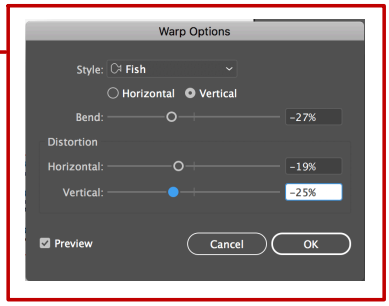


Using the blend tool to illustrate deteriorating cell

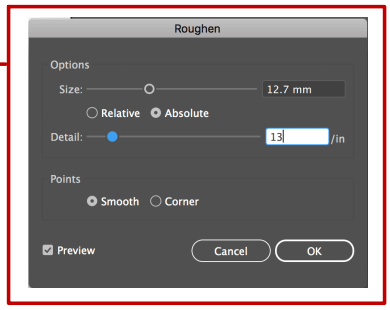
This tutorial makes use of the blend tool to illustrate the process of apoptosis. Organelles, e.g. nucleus can be added to the cells but this tutorial sticks to quite a simplified depiction.

1. Create two ellipses that are 30x30 mm. Give them two different fill colours (no stroke).

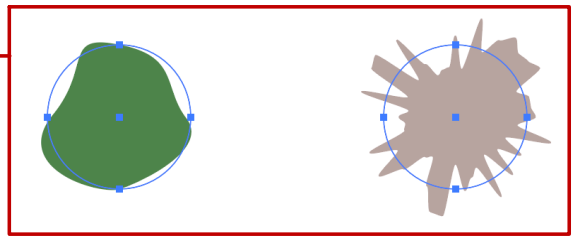
2. Select the green circle and go to *Effects> Warp>Arc*. In the dialogue that opens, enter the shown parameters.



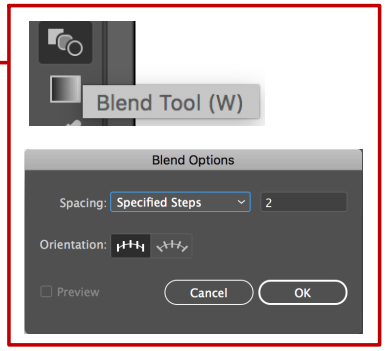
3. Select the brown circle and go to *Effects> Distort&Transofrm>Roughen*. In the dialogue that opens, enter the shown parameters.



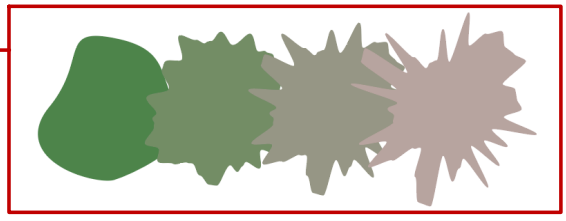
4. Select the two shapes and go to *Object> Expand Appearance*. And again *Object> Expand.*



5. With the two shapes selected, double click on the **Blend Tool** from the tool bar. In the dialogue that opens, enter the shown parameters.



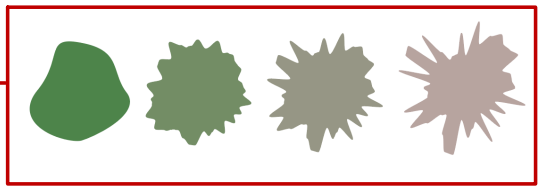
6. With the blend tool shown, click on the green cell and then the brown one. It should look something like this:



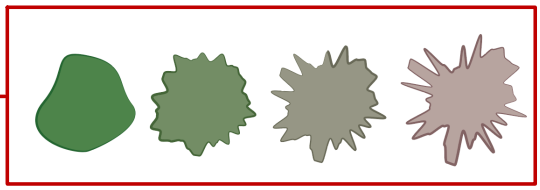
7. Select all the shapes then go to Object> Expand (Select OK to default parameters in the dialogue that opens).

8. Space the cells evenly to show their deterioration clearly.

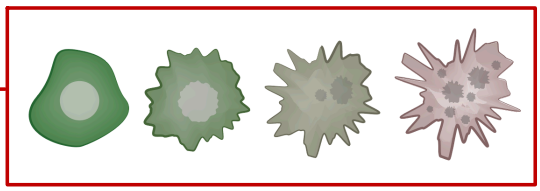
- **a.** Drag the rightmost cell further to the right.
- **b.** Select all cells, then go to *Window> Align* and under Distribute Spacing, choose **Horizontal Distribute Space**.



9. Give all the cells a stroke that is slightly darker than their fill colour (e.g. 286733, 47683A, 6C6D58, 856666, respectively). In the Strokes panel (*Window>Stroke*) change the weight to 2 pt and choose a width profile as desired.



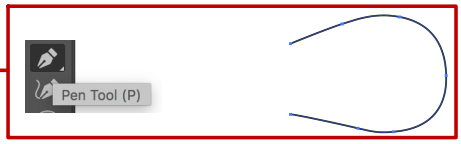
Fill can be modified to a gradient mesh (to give the cell depth). First make a copy of the four cells and then follow the instructions in the gradient mesh tutorial. Nuclei can be added by repeating Blend tool process (steps 1-6) with a circle (start point) and a rough circle. Place the nuclei and make copies of the rougher circles to depict nuclear blebbing.



Using 3D effects to make a red blood cell

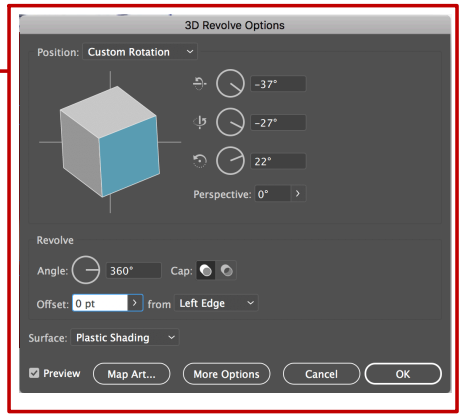
This tutorial makes use of the 3D illustrator effects to create a red blood cell as an example - but the effect can be used for a wide range of rendering (e.g. to make hollow rings). This is based on a tutorial initially described by Emily Holden and shown during a demonstration by David Bacon (Francis Crick Institute).

1. Draw half a cross section of a red blood cell using the **pen tool**.

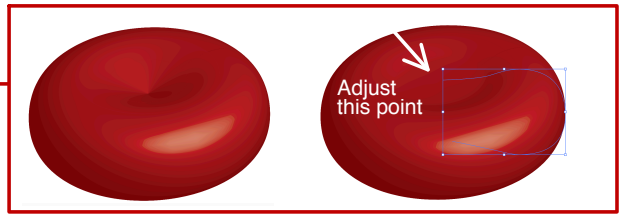


2. Fill the shape with a red colour (e.g. C10017) and remove the stroke.

3. In the upper toolbar, select *Effect>3D> Revolve*. In the dialogue that opens, enter the shown parameters (tick preview to see how this changes the shape).

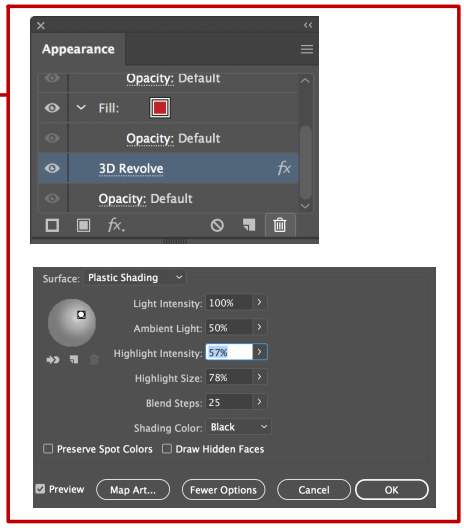


4. Using the direct selection tool (White arrow or press "A" on the keyboard), adjust the point to make the shape resemble a red blood cell.

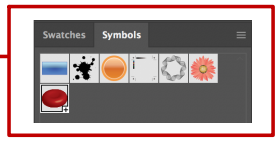


5. Adjust the lighting if desired by going to *Window>Appearance* and clicking on the Revolve section.

In the window that appears, you can click More options and play around with the shading options (e.g. diffuse vs plastic etc). In this example, shading is left to its default values.



6. Make the cell smaller then make sure that the Symbols panel is open (*Window> Symbols*). Drag the cell into the Symbols window and give it a name (e.g. RBC).



7. With the full toolbar open (Window>Toolbar>Advanced), select the **Symbol Sprayer Tool**. Go across the document and "spray". You can go quite randomly at first and then adjust.

Double clicking on the Symbol Sprayer Tool allows adjustment of the angles, spacing and direction of the RBCs.

Tip: create 4 different red blood cells oriented differently and make 4 separate symbols. Spray these interwoven with each other to give a more realistic feel of flowing blood. Example shown.