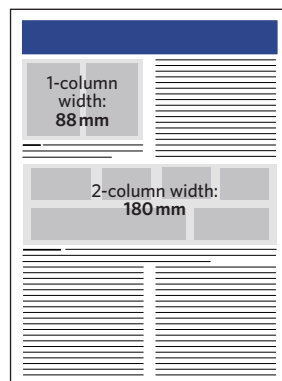


Please take particular care to follow these guidelines for your final submission. Figures submitted in inappropriate formats will cause delays in processing your manuscript for publication. All figures must meet *Nature* standards for content and visual quality and will be redrawn to house style by an art editor where necessary.

Figure sizes

Provide files at approximately the optimal display size, as indicated below.

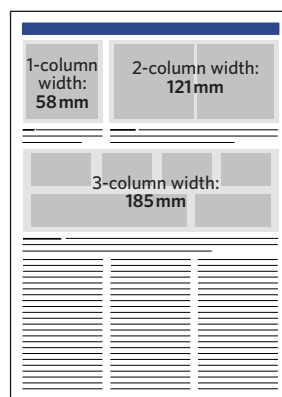
Original research and review content



Includes:

Analysis, Article, Brief Communication, Consensus Statement, Hypothesis, Letter, Perspective, Progress Article, Resource, Review Article, Technical Report

All other content



Text

- All text should be sans-serif typeface, preferably Helvetica or Arial.
- Maximum text size is 7pt. Minimum text size is 5pt.

Colour

- Original research content should be supplied in RGB colour mode.
- All other content (including Perspectives, Progress Articles and Review Articles) should be supplied in CMYK colour mode.

Chemical structures

- If you are supplying a composite figure in a format other than .cdx but it contains ChemDraw structures, please also supply the ChemDraw elements in a separate .cdx file following the style guidelines. Please refer to the [Chemical Structure Guide](#) and use the [downloadable template](#) to format your structures.

Stereo images

- In the final accepted version of the manuscript, submit stereo images at their final print size.

Permissions

- Clarify the source of any images that you do not own.
- We cannot publish any third-party images without securing the appropriate rights.

BioRender

- BioRender figures must be included on our Third Party Rights form. Please confirm whether you own a full licence to publish or a free trial plan.

- Wikimedia and Flickr:** These public sites should be avoided as the information of who holds copyright is often absent or unreliable.

- We cannot publish images downloaded from the internet unless they are released under the correct [Public Domain licence](#).
- If you want to use an image obtained from a photo library, do not purchase it. Instead, supply us with the library catalogue number and a low-resolution placeholder. We will secure publication rights and obtain the final version on your behalf.

Saving figure panels

Save graphs, charts, schematics or other line art as **vector files**.

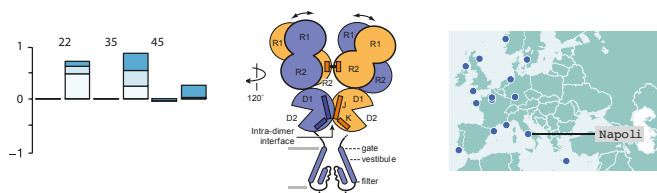
Save photographs or complex illustrations as **bitmap files**.

Vector files: AI, EPS, PDF

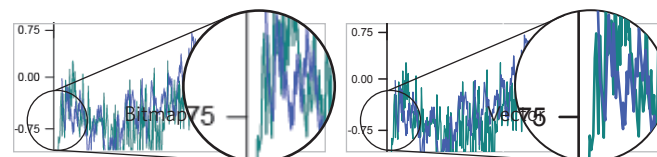
All line art, graphs, charts and schematics should be saved/exported directly from the original application and file in which they were generated.

- To create vector files, open the original figure file in the application that it was created in. The text, data, lines and colours in this file should remain editable. Directly save/export the file as one of these file formats: AI, EPS or PDF. We cannot use bitmapped file types such as BMP, GIF, GIMP, JPG, PNG, Tex or TIFF for vector art.

Examples of figure types that should be supplied in vector format



Difference between bitmap and vector

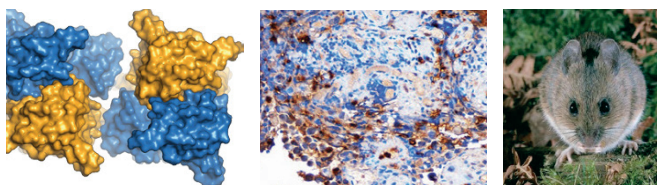


The pixelation becomes more apparent on bitmapped images the closer the reader zooms in.

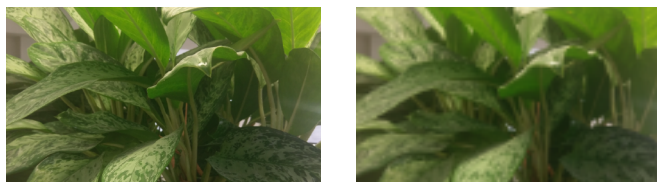
Bitmapped files: BMP, GIF, GIMP, JPG, PNG, Tex, TIFF

- All photos and complex technical illustrations, e.g. 3D-rendered graphics, should be directly saved/scanned in *at least* 300 dpi resolution at the maximum size that they could be used.
- Do not artificially increase the resolution of images in graphics applications such as Photoshop as this does not improve quality. Images should retain the best available resolution of the source files.

Examples of figure types that should be supplied as high-resolution bitmaps



Difference between high-resolution and low-resolution images



The pixelation becomes more apparent on low-resolution images the closer the reader zooms in.

Microsoft Office

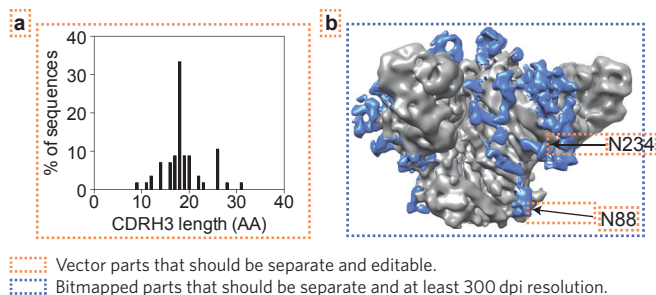
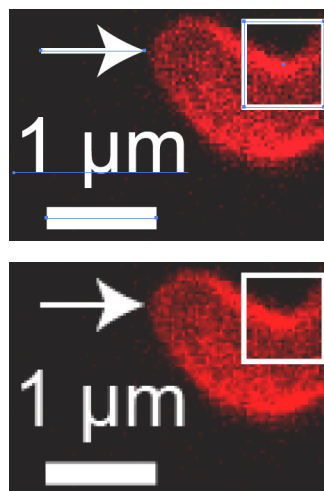
- **Word:** We *do not* recommend using this because layers and vectorised formats can downgrade and flatten depending on how an image will import or paste.
- **Excel:** Please convert figures to PDF.
- **Powerpoint:** We can accept this if the figures are fully editable.
- Do not add graphical effects (e.g. drop shadow, 3D rotate and bevel) to objects, as these are exported as low resolution bitmaps

Adobe Photoshop

- We *do not* recommend Photoshop for creating figures. It is a 'raster' picture-based application, files are often large and difficult to process, and vector data can easily become flattened. This causes further delay when the production team have to retrieve editable files from authors.
- If you do decide to use Photoshop, PSD, TIFF or EPS, files will work provided that all text remains fully editable in 'type layers', and line-art (e.g. graphs, diagrams and symbols) are preserved and embedded within 'vector smart objects'.

Combining vectors and bitmaps for final layout**Compiling final figures**

- When combining different figure parts into one file for layout, use a vector-based application such as Adobe Illustrator or Microsoft Powerpoint. - We recommend: AI, EPS, PDF, PPT
- Do not use applications that do not support vector format. - We do not accept: BMP, GIF, GIMP, JPG, PNG, Tex, TIFF
- Place all bitmapped images into the layout application at 300 dpi or at the native resolution if captured at less than the optimal 300 dpi.
- All text, and any overlaying elements, such as lines, axes, boxes, arrows and scale bars, should be in editable vector format and laid over the bitmapped images in the layout application.
- Try to keep each final figure to a maximum of 50 MB file size.

Example of a figure with both vector and bitmapped parts**Example of overlaying vector elements onto bitmapped image**

✓
All overlaid elements
are separate and
editable

✗
All elements have
been flattened and
are not editable