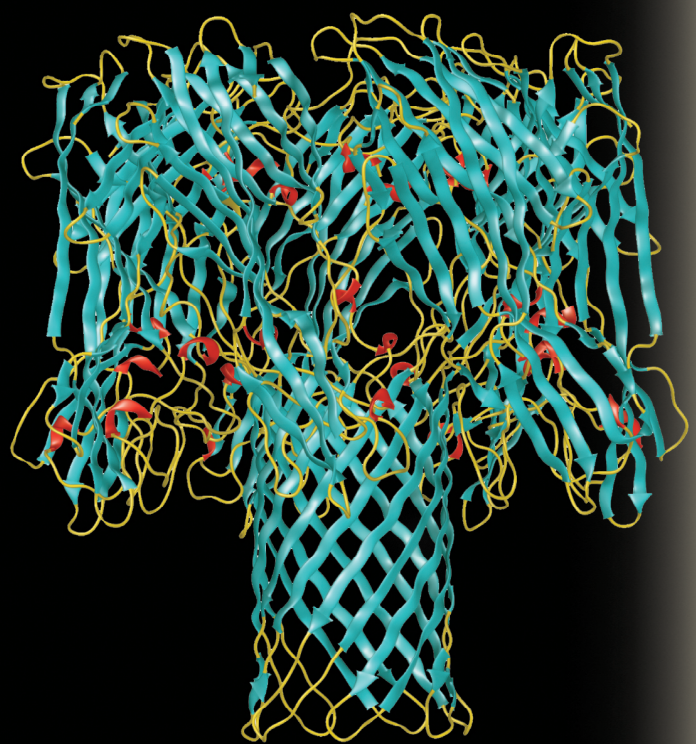
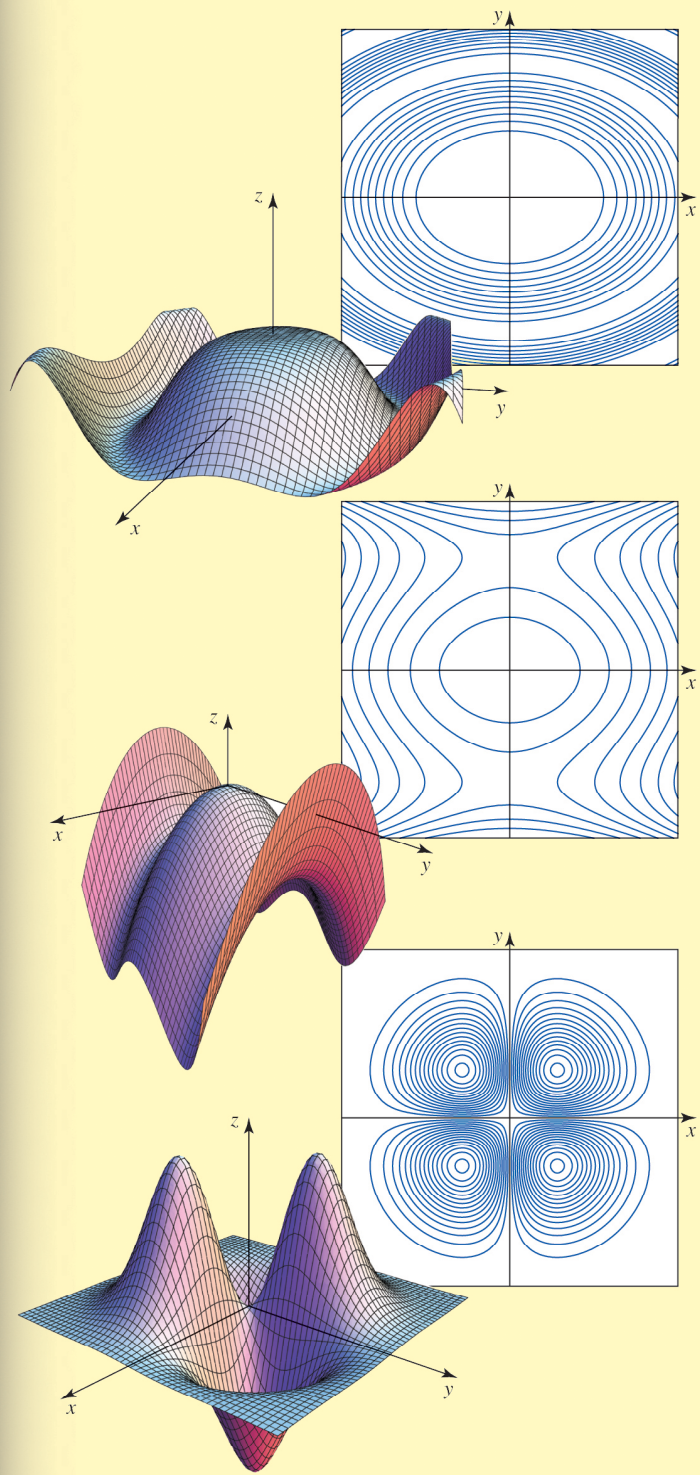
From *Mathematica* to Manuscript:

Publishing and Preparation of Scientific Content

Jan Troutt
Becky Oles
Dan Whitaker
Jeff Griffin



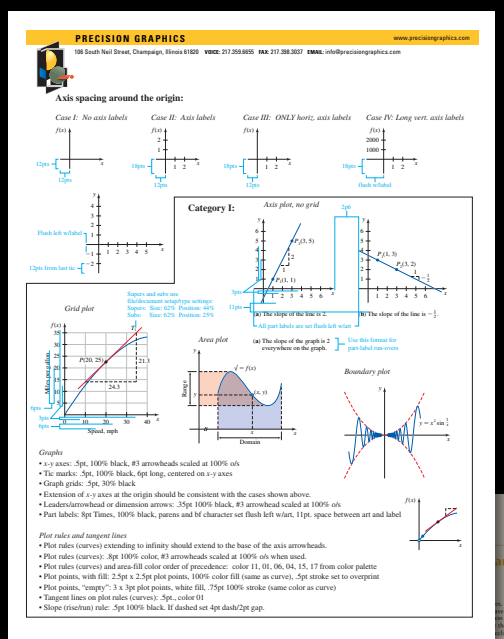


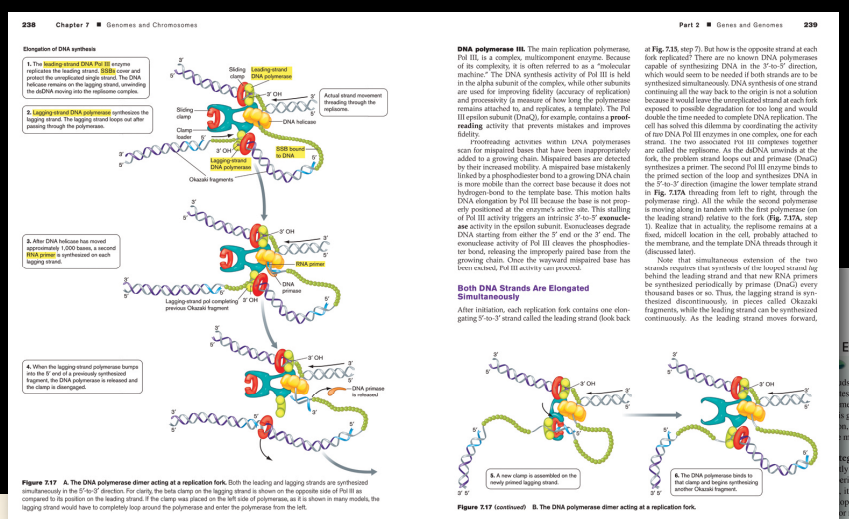
• Precision Graphics • Champaign, IL

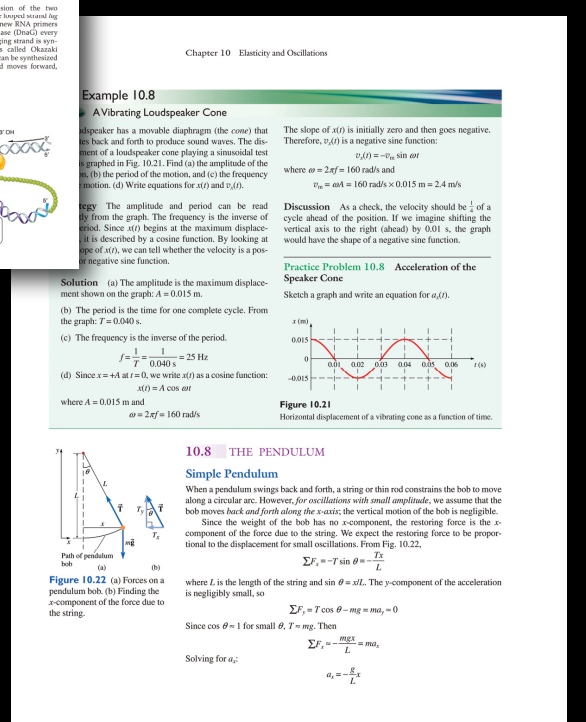
Precision Graphics

Over 31 years of producing composition and visuals for educational publishing.

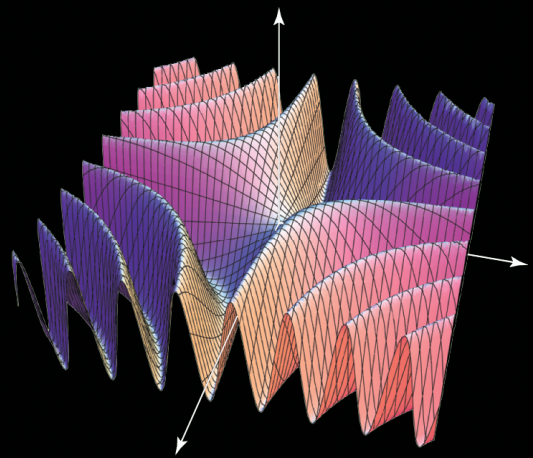
Located in Champaign, Illinois



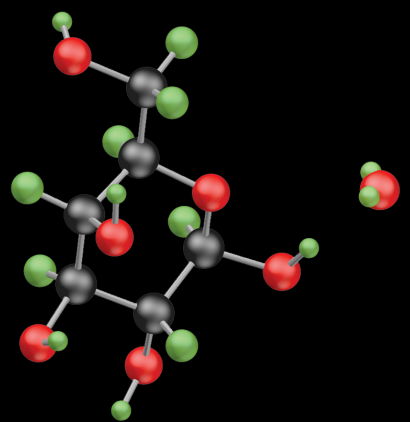




Precision Graphics & Wolfram Research

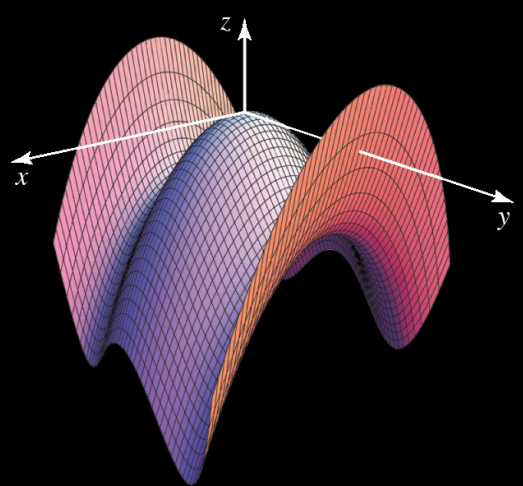


- Precision Graphics started working with *Mathematica* on high-end math titles many years ago to plot both 2D and 3D equations.



- We found that content beyond math equation-driven visuals was available through *Mathematica* and that it worked well with our Illustration tools.

- We are seeing more authors providing *Mathematica* Notebook (.nb) files as source images on Physics, Calculus, etc. and time is saved in rendering.



Accurate Content

Illustrated scientific content should be easy to understand and rendered in a clear way.

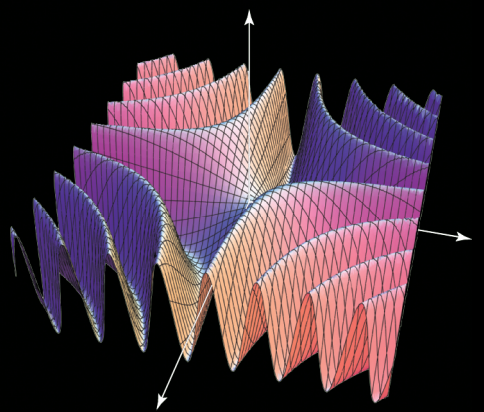
All of this is secondary to Accuracy! If content is not accurate then the value is not there.

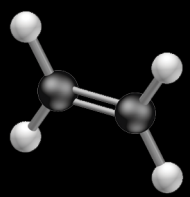
REMEMBER

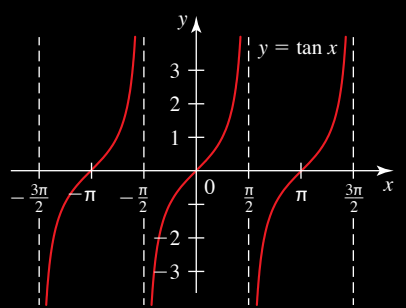
• Don't assume the artist knows the content. Often, artists will be familiar with the subject being illustrated but information changes quickly.

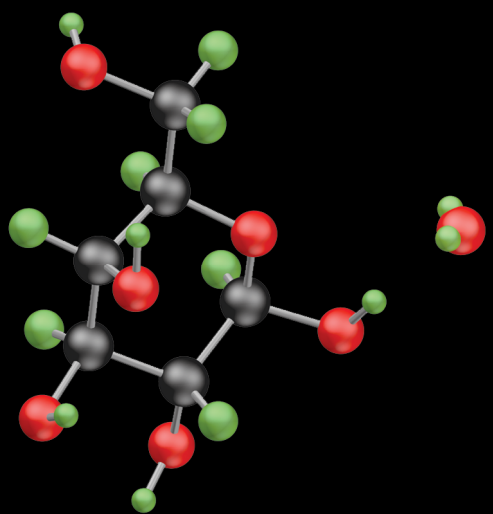
• Set expectations early for who will be developing content, how the content will be delivered and what the workflow will be for review.

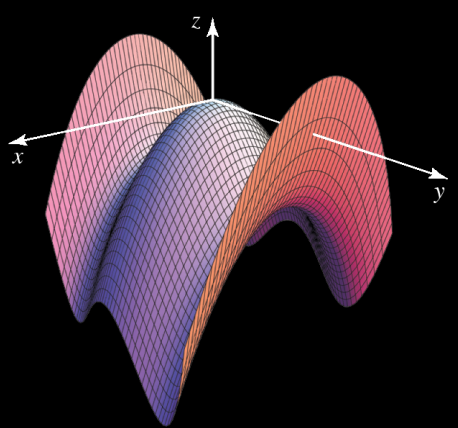
How can we move ideas from the mind of the content creator to the artist with the least amount of translation?

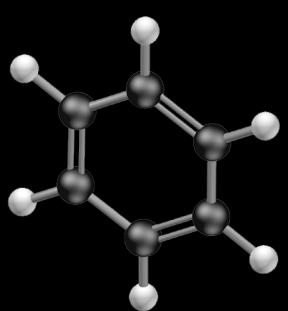


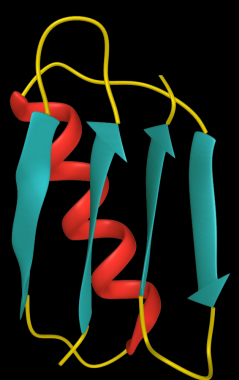




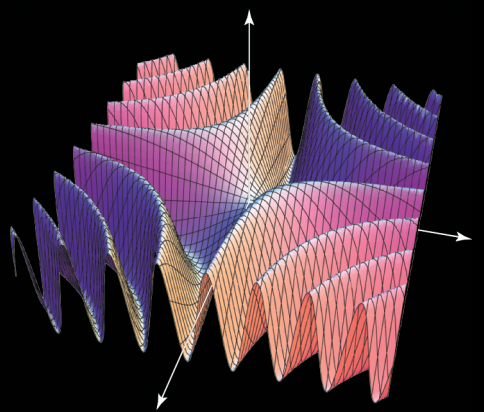


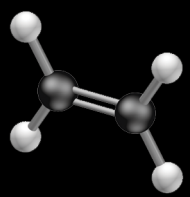


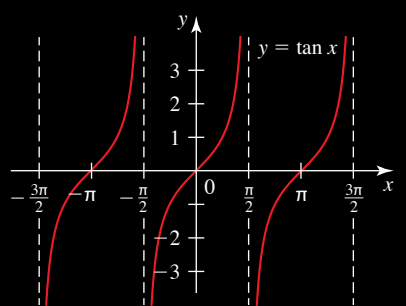


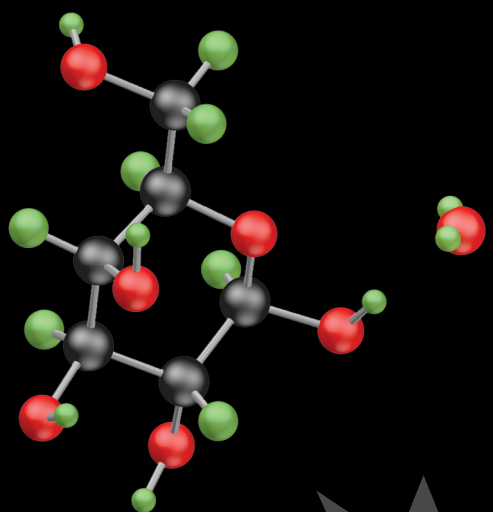


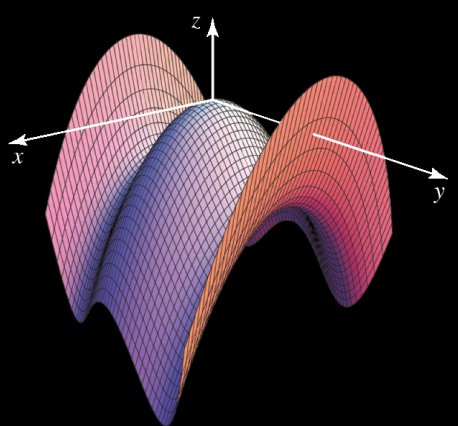
How can we move ideas from the mind of the content creator to the artist with the least amount of translation?

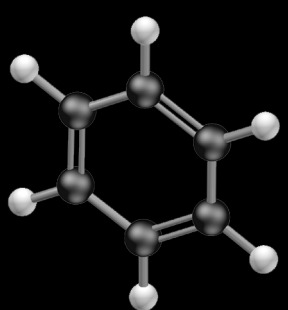


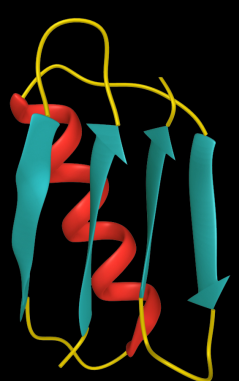




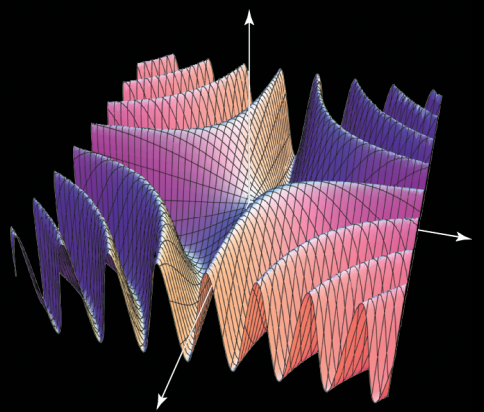


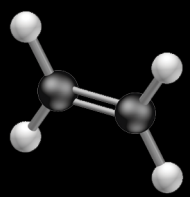


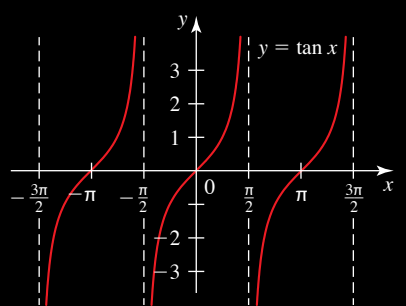


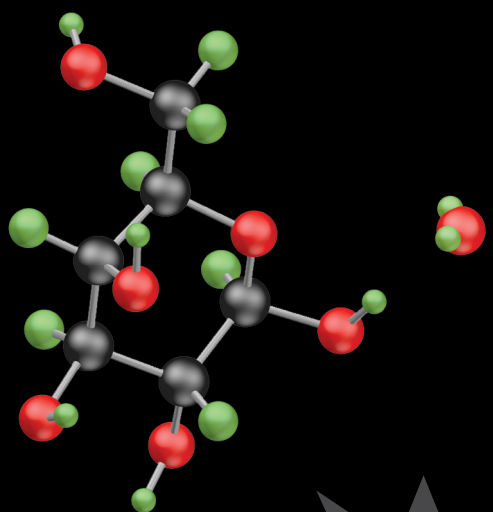


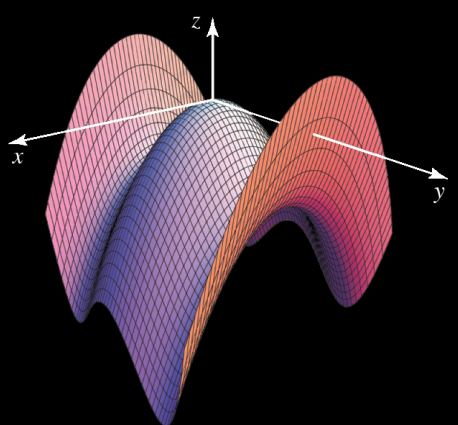
How can we move ideas from the mind of the content creator to the artist with the least amount of translation?

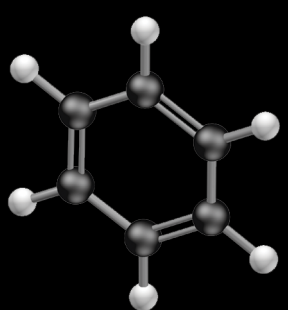


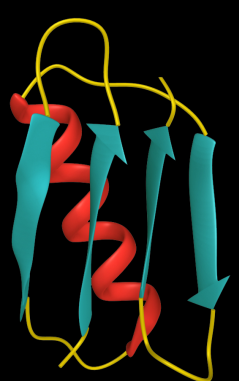












.nb files!

I’m ready to start. How do I communicate my thoughts?

I’m ready to start. How do I communicate my thoughts?

Transfer information in an organized and clear way

I’m ready to start. How do I communicate my thoughts?

Transfer information in an organized and clear way

- Give an idea of how you want information presented - Is this a 3-dimensional object? If so, what view best shows what I’m trying to convey? How do I let the artist know this? How large do you want this? Does it need to have an environment or background image?

I’m ready to start. How do I communicate my thoughts?

Transfer information in an organized and clear way

• Give an idea of how you want information presented - Is this a 3-dimensional object? If so, what view best shows what I’m trying to convey? How do I let the artist know this? How large do you want this? Does it need to have an environment or background image?

• Are there supporting images needed - If I’m showing statistics about a specific country, would it be helpful to have a locator map to go along with it? Would the information be clearer with bar charts, pie graphs, etc.?

I’m ready to start. How do I communicate my thoughts?

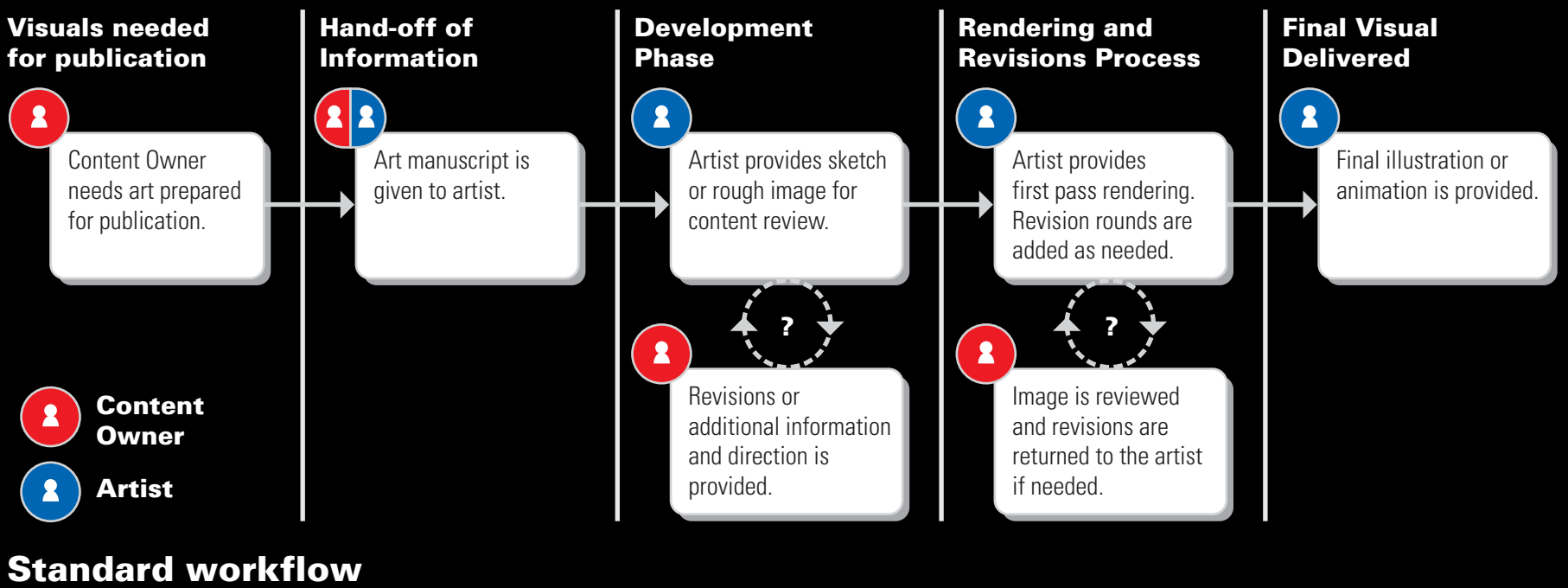
Transfer information in an organized and clear way

• Give an idea of how you want information presented - Is this a 3-dimensional object? If so, what view best shows what I’m trying to convey? How do I let the artist know this? How large do you want this? Does it need to have an environment or background image?

• Are there supporting images needed - If I’m showing statistics about a specific country, would it be helpful to have a locator map to go along with it? Would the information be clearer with bar charts, pie graphs, etc.?

• Prepare clear instructions for the visuals - Make sure the artist knows what is live manuscript and what is supporting reference materials and instructions.

Standard Pathway from Concept to Creation of Visuals



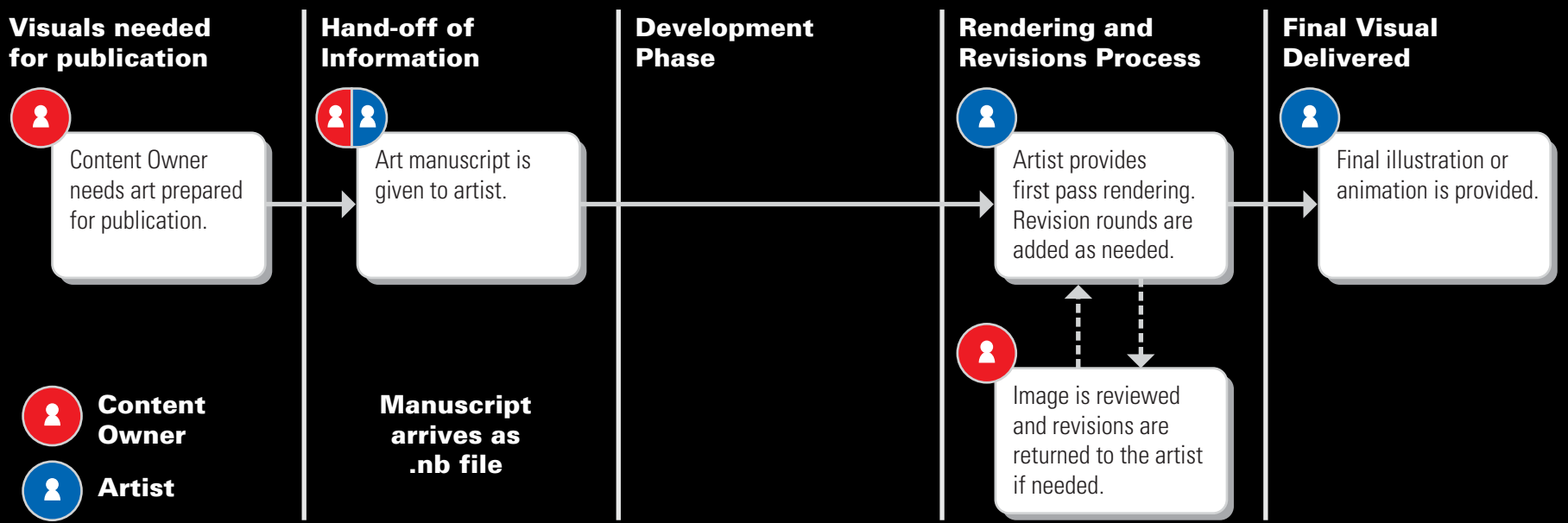
Standard workflow

- The better the handoff of content and instructions at the onset of this workflow the smoother the steps following.
- Development stage could be eliminated or significantly reduced by using .nb files as a starting manuscript.
- Correction passes can be reduced and the art schedule shortened if useable content is provided at the onset along with clear instructions.

Standard Pathway from Concept to Creation of Visuals

- The better the handoff of content and instructions at the onset of this workflow the smoother the steps following.
- Development stage could be eliminated or significantly reduced by using .nb files as a starting manuscript.
- Correction passes can be reduced and the art schedule shortened if useable content is provided at the onset along with clear instructions.

Standard Pathway from Concept to Creation of Visuals



Workflow using .nb file as manuscript

- The better the handoff of content and instructions at the onset of this workflow the smoother the steps following.
- Development stage could be eliminated or significantly reduced by using .nb files as a starting manuscript.
- Correction passes can be reduced and the art schedule shortened if useable content is provided at the onset along with clear instructions.

Value in information handoff via .nb files

Value in information handoff via .nb files

- Author has more control over his or her content.

Value in information handoff via .nb files

- Author has more control over his or her content.
- Artist has content that can be imported directly into their applications.

Value in information handoff via .nb files

- Author has more control over his or her content.
- Artist has content that can be imported directly into their applications.
- Importing content can be reflected in time and cost savings.

Value in information handoff via .nb files

- Author has more control over his or her content.
- Artist has content that can be imported directly into their applications.
- Importing content can be reflected in time and cost savings.
- Accuracy is maintained working with original materials.

The Spectrum of Manuscript

The Spectrum of Manuscript

- Written description - Most subjective and open to artist interpretation.

The Spectrum of Manuscript

- Written description - Most subjective and open to artist interpretation.

- Example from competitor - Gives basic content but making it new and different can introduce content errors.

The Spectrum of Manuscript

- Written description - Most subjective and open to artist interpretation.

- Example from competitor - Gives basic content but making it new and different can introduce content errors.

- Hand drawn author sketches - This gives great information about layout, content, labeling, and general level of information.

The Spectrum of Manuscript

- Written description - Most subjective and open to artist interpretation.

- Example from competitor - Gives basic content but making it new and different can introduce content errors.

- Hand drawn author sketches - This gives great information about layout, content, labeling, and general level of information.

- Data to scan and trace or input - Accurate content but when complex can take time to render and proof to make sure all data traced accurately. Open to input error.

The Spectrum of Manuscript

- Written description - Most subjective and open to artist interpretation.

- Example from competitor - Gives basic content but making it new and different can introduce content errors.

- Hand drawn author sketches - This gives great information about layout, content, labeling, and general level of information.

- Data to scan and trace or input - Accurate content but when complex can take time to render and proof to make sure all data traced accurately. Open to input error.

- .nb file as manuscript - Accurate and ready to use content!

The Spectrum of Manuscript

More subjective and a larger leap to final image

Less subjective and efficient steps to final image

Written description

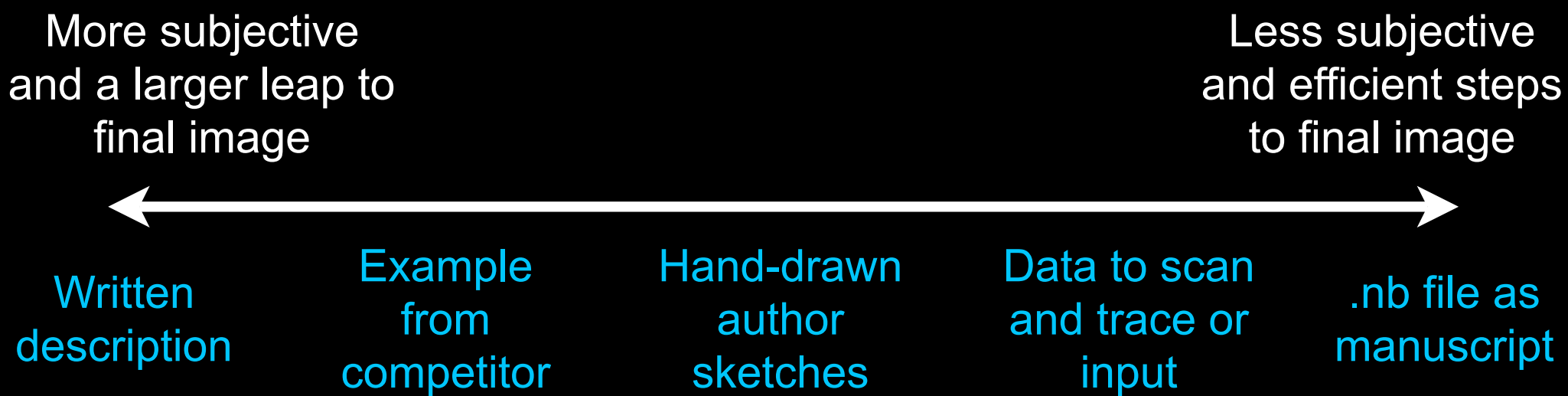
Example from competitor

Hand-drawn author sketches

Data to scan and trace or input

.nb file as manuscript

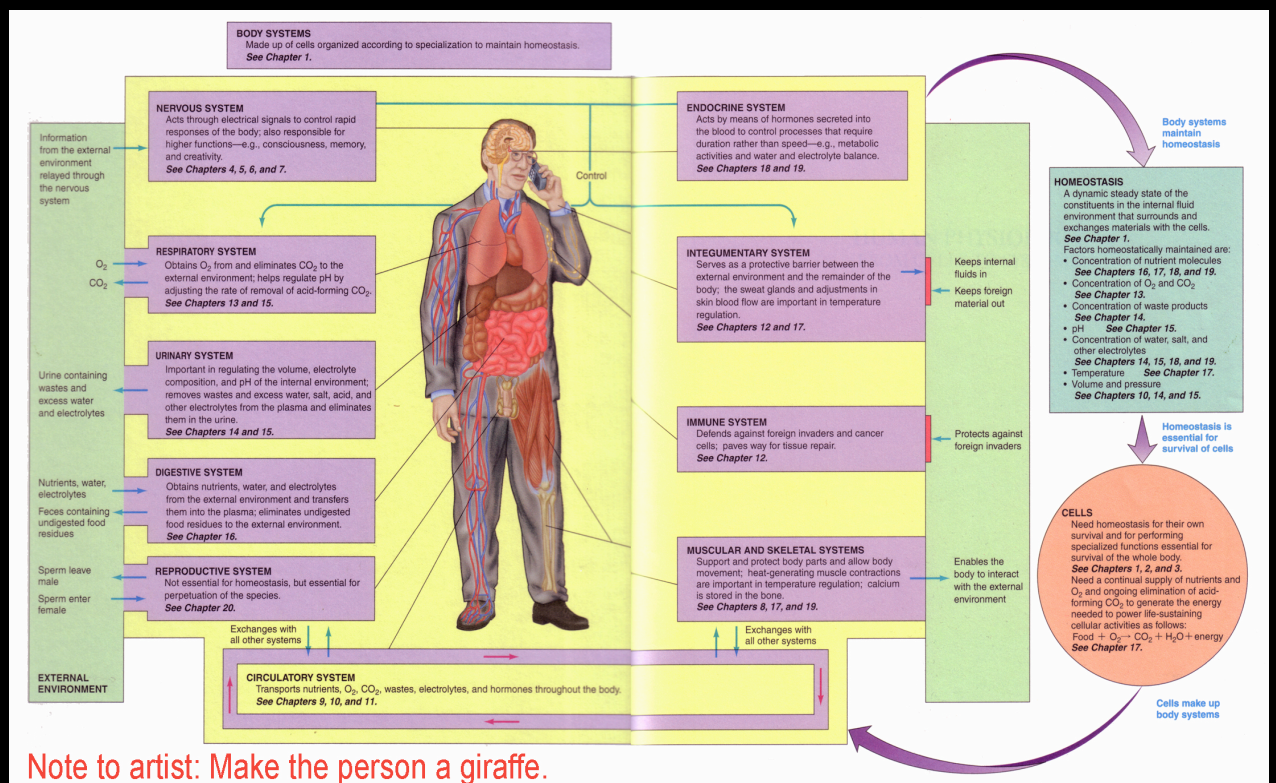
The Spectrum of Manuscript



We can work with all types of manuscript to get a well rendered final image. However, the more subjective or unclear the manuscript, the larger the leap between supplied information and final image.

Following are some examples of types of manuscript and where they might be improved to streamline the workflow.

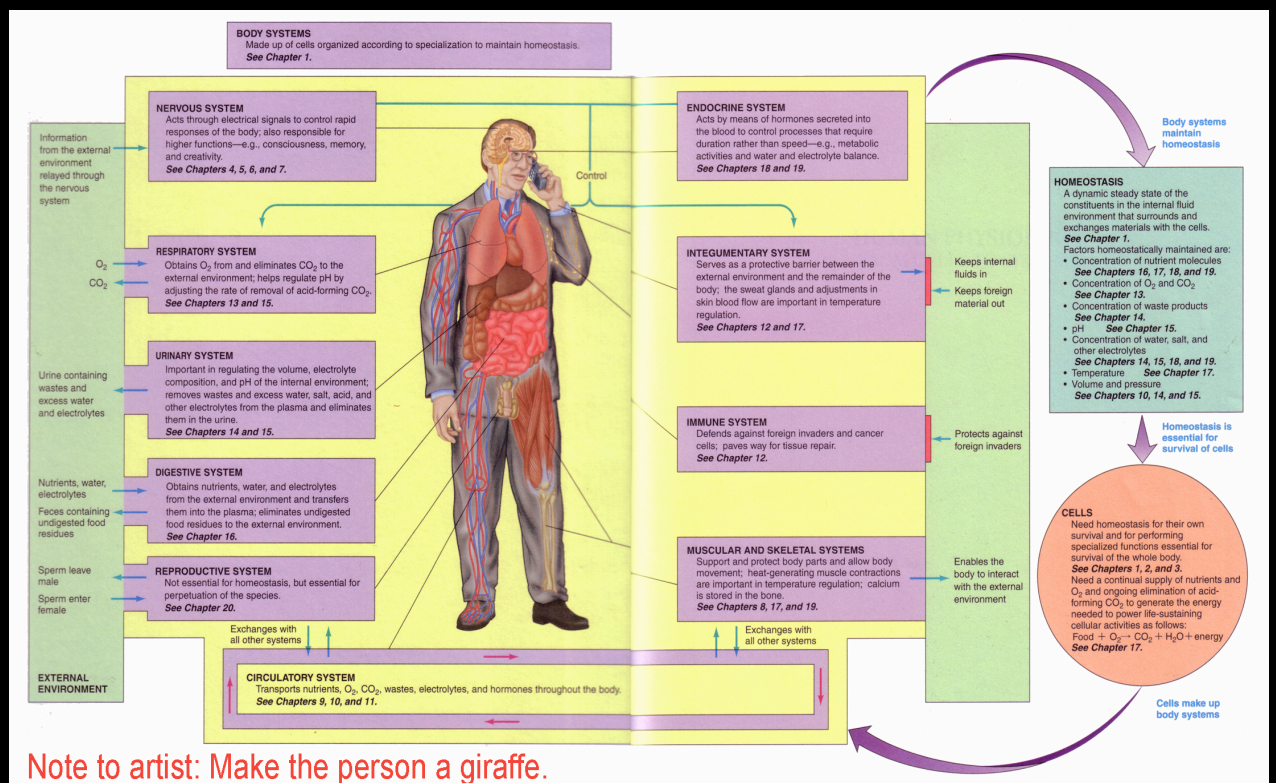
The Spectrum of Manuscript - Bad



Note to artist: Make the person a giraffe.

← Good reference for layout and labeling

The Spectrum of Manuscript - Bad

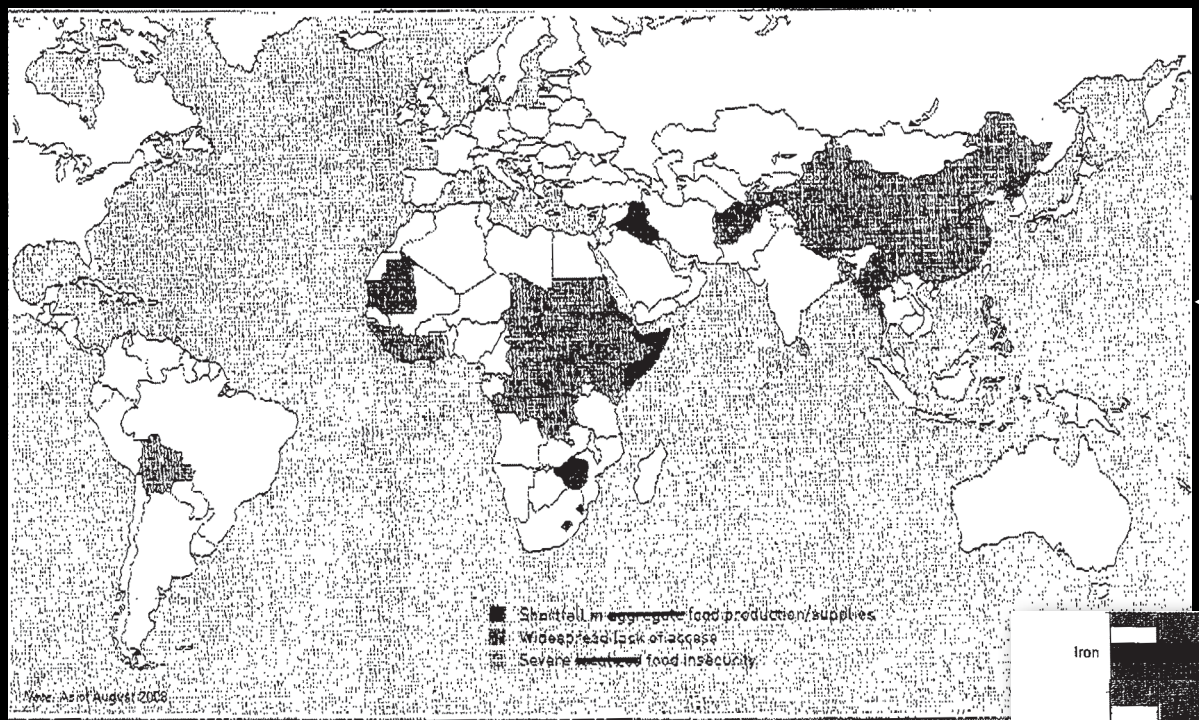


← Good reference for layout and labeling

but...
Artist instructions make artist gather all content reference and information.

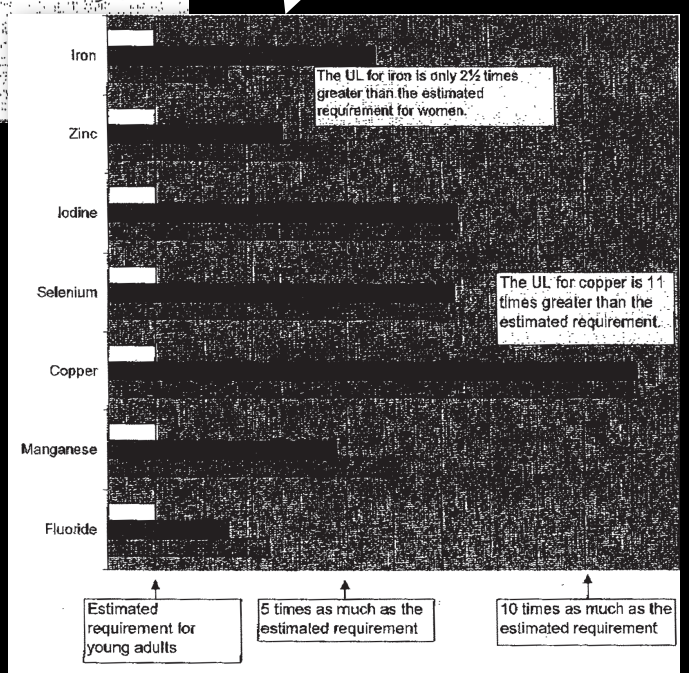
↓

The Spectrum of Manuscript - Bad



Color map according to key

Manuscript pages provided are what the author wants



but... quality of manuscript is bad. Artist will have difficulty in confirming the content when they redraw.

The Spectrum of Manuscript - Bad

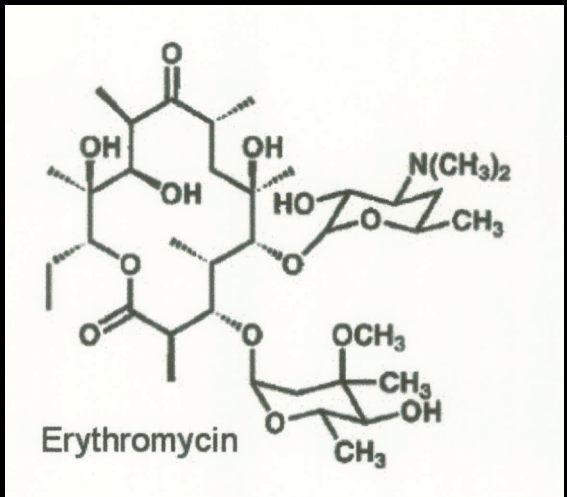


Fig. 11.2. Show as 3D ball and stick model

← 2D reference for 3D image.
Artist is responsible for pulling content.

The Spectrum of Manuscript - Bad

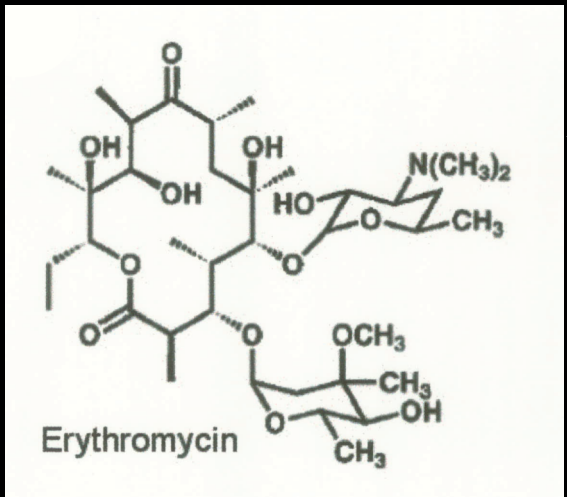
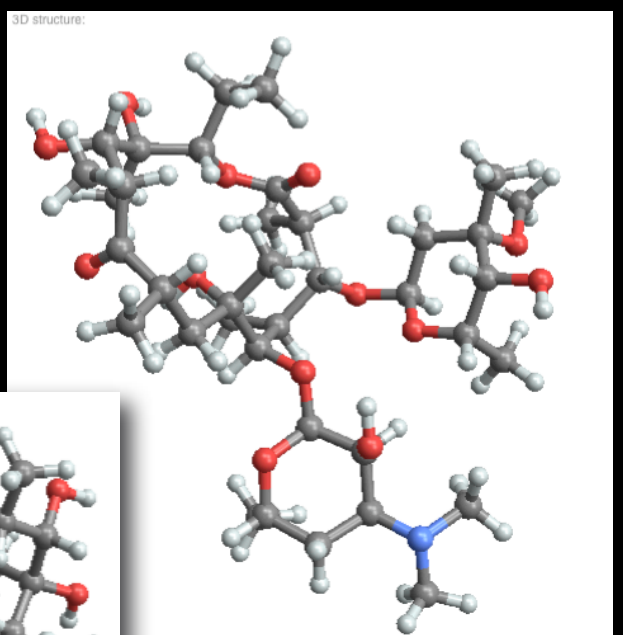
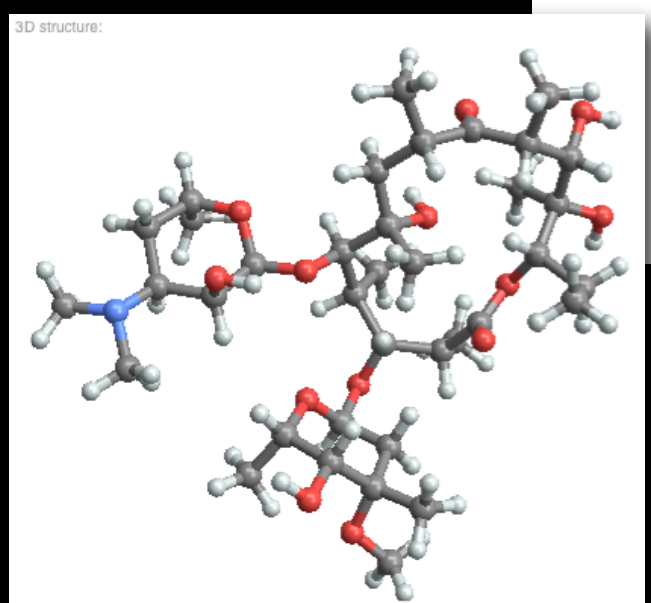


Fig. 11.2. Show as 3D ball and stick model

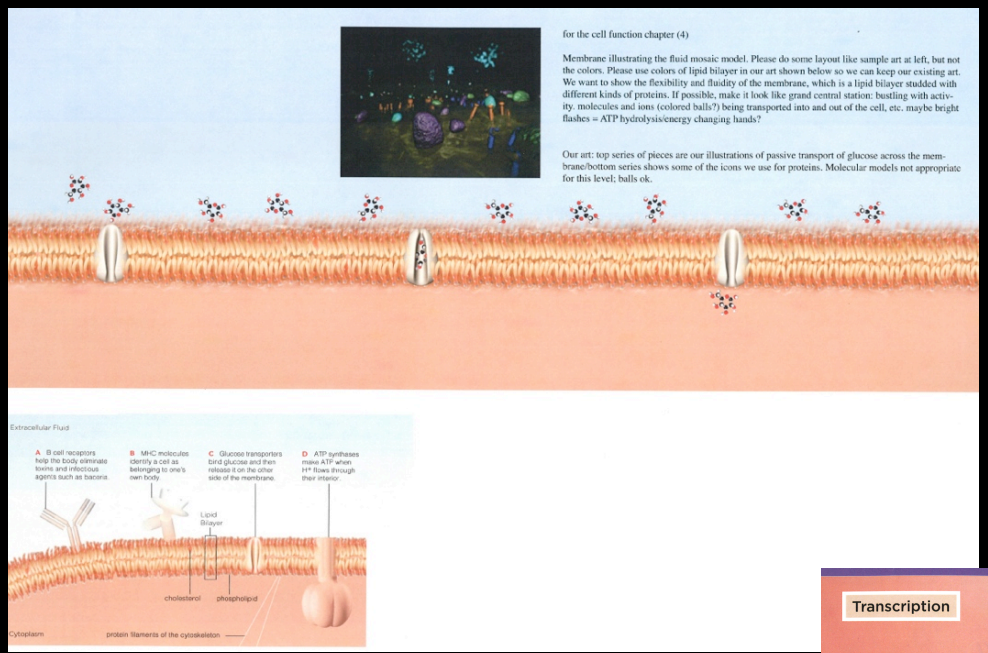
← 2D reference for 3D image.
Artist is responsible for pulling content.



but... these .nb files would have been helpful to clarify what is wanted, give author control over view, and provide artist with useable content from the start. →



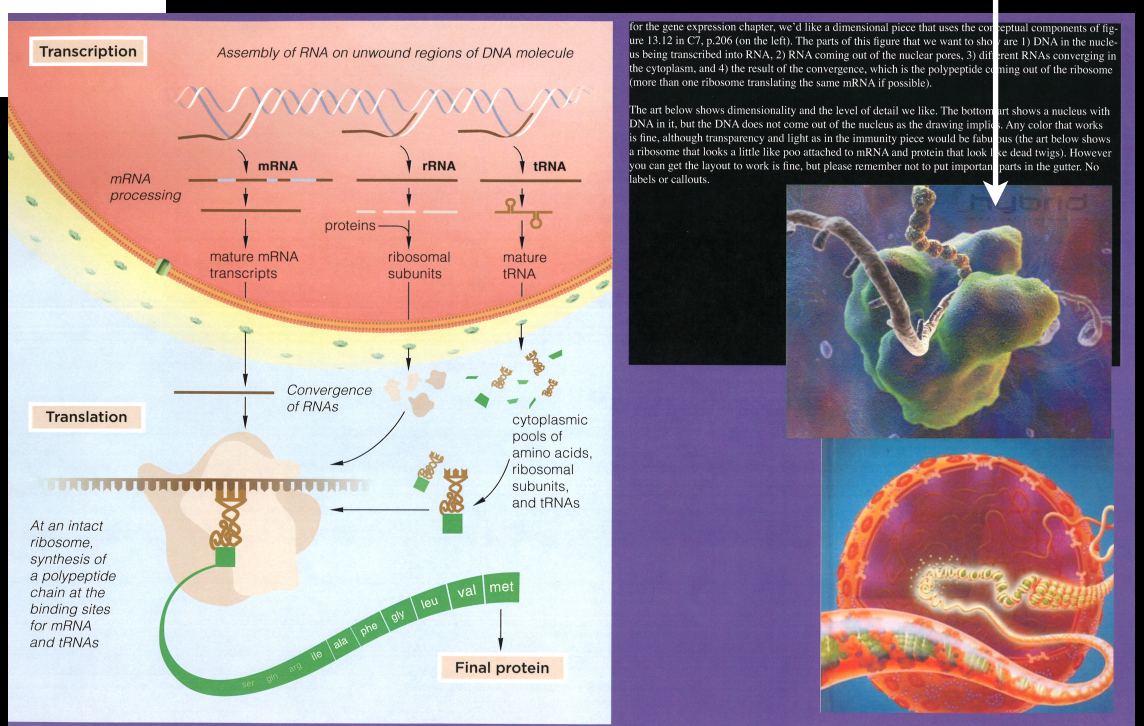
The Spectrum of Manuscript - Better



← Artist instructions

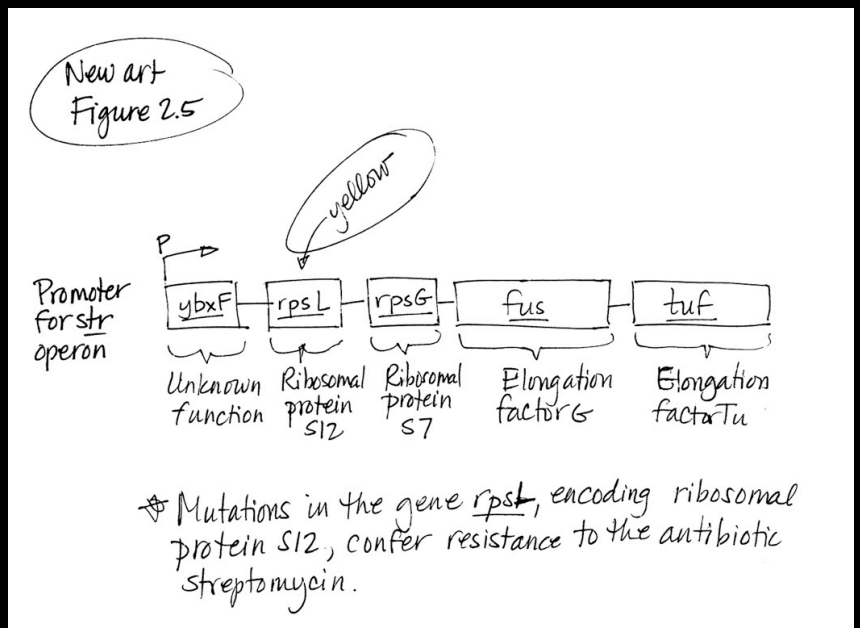
References

Content and callouts →

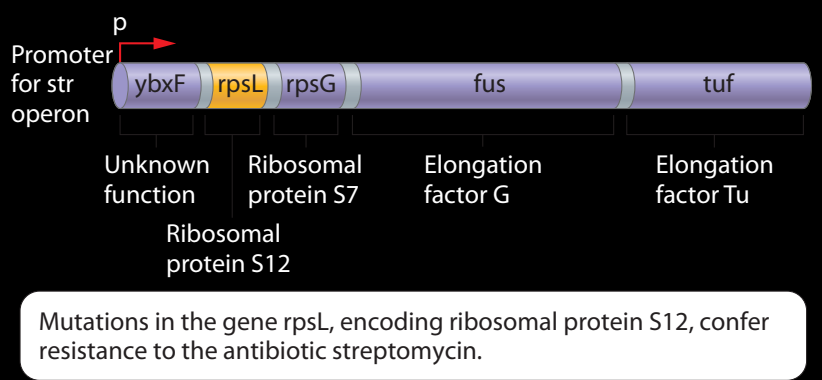


but... artist needs to render in new and different layout

The Spectrum of Manuscript - Good



Hand drawn author sketches

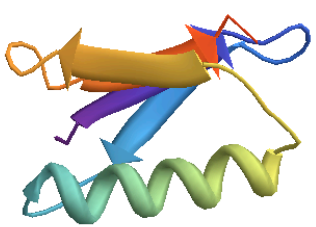


Final art drawn from manuscript

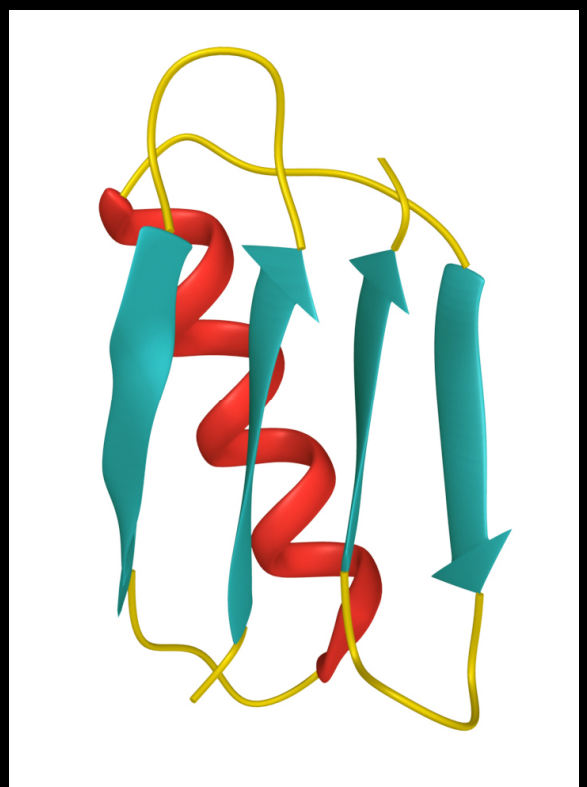
The Spectrum of Manuscript - Now we're talking!!

.nb Files Save Time, Cost, and Reduces Introduced Errors

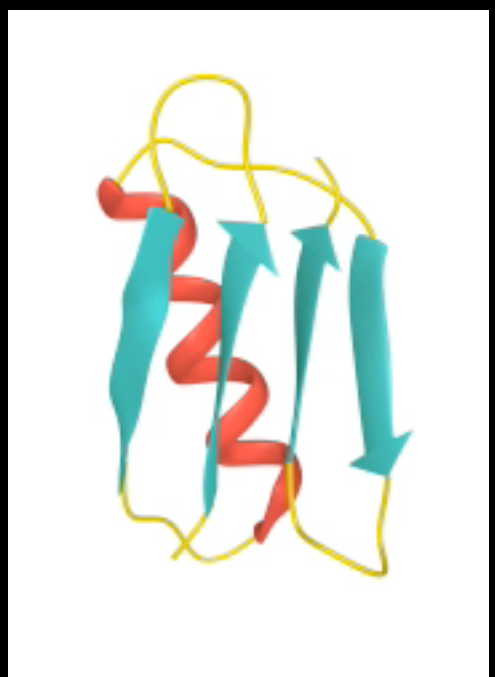
```
ribbonG = Import["/Users/jgriffin/Desktop/PG_work/2NMQ.pdb"]
ballnstickG = Import["/Users/jgriffin/Desktop/PG_work/2NMQ.pdb",
  "Rendering" → "BallAndStick"]
spacefillG = Import["/Users/jgriffin/Desktop/PG_work/2NMQ.pdb",
  "Rendering" → "Spacefilling"]
wireframeG =
 ballnstickG /. {Sphere[x_, y_] :> Sphere[x, 10], Cylinder[x_, y_] :> Cylinder[x, 10]}
```



.nb file as manuscript



Final printed file



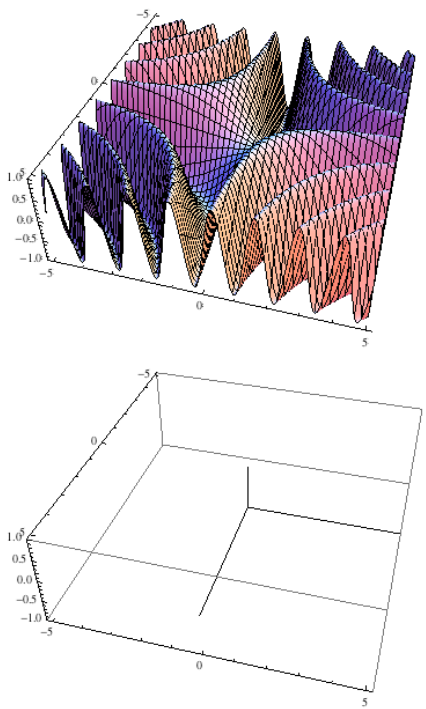
Final animation

The Spectrum of Manuscript - Now we're talking!!

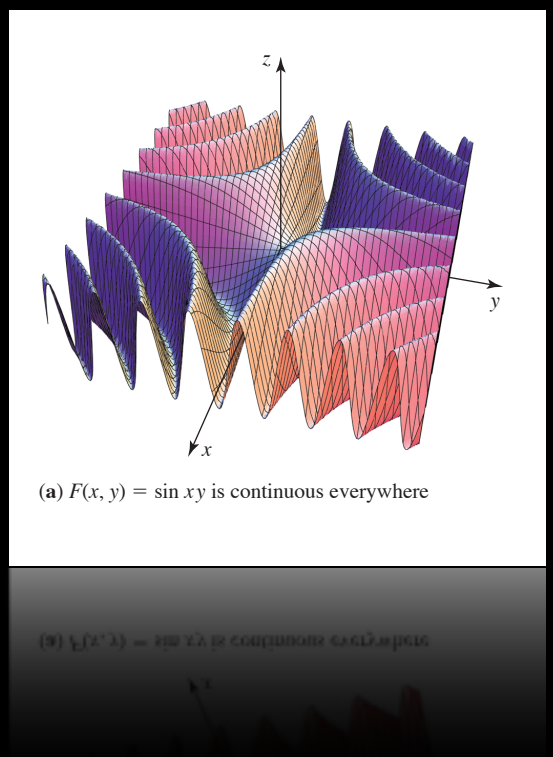
.nb Files Save Time, Cost, and Reduces Introduced Errors

```
fname = fdir <> fpref <> "_REF2.pdf";
Show[Plot3D[f[x, y], {x, xMin, xMax}, {y, yMin, yMax}, Axes → True, Boxed → True,
  ViewPoint → vPoint, PlotRange → pRange, BoxRatios → bRatio],
 Graphics3D[{Yellow, Thick, Line[{Origin, Origin + {0, 10, 0}}]}],
 Graphics3D[{Yellow, Thick, Line[{Origin, Origin + {10, 0, 0}}]}],
 Graphics3D[{Yellow, Thick, Line[{Origin, Origin + {0, 0, 10}}]}]]
Export[fname, %];
```

Sin[x y]



.nb file as manuscript

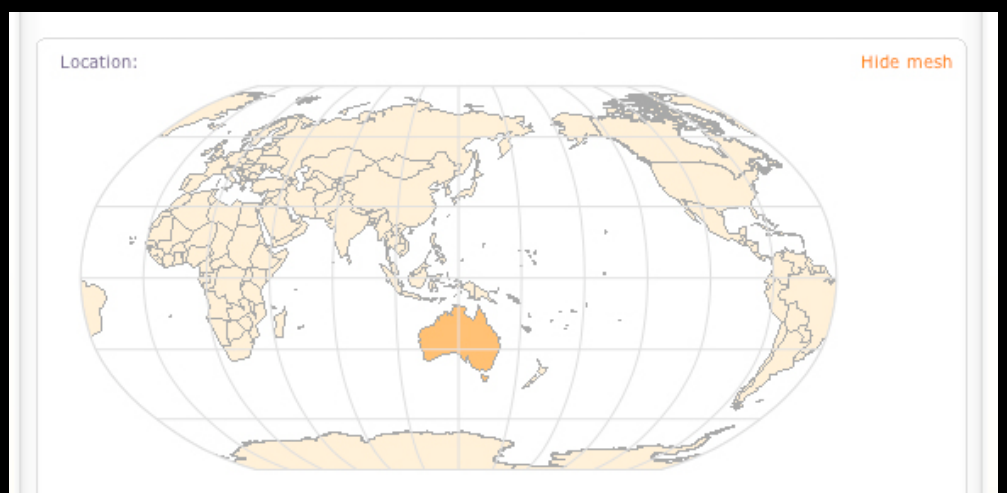


(a) $F(x, y) = \sin xy$ is continuous everywhere

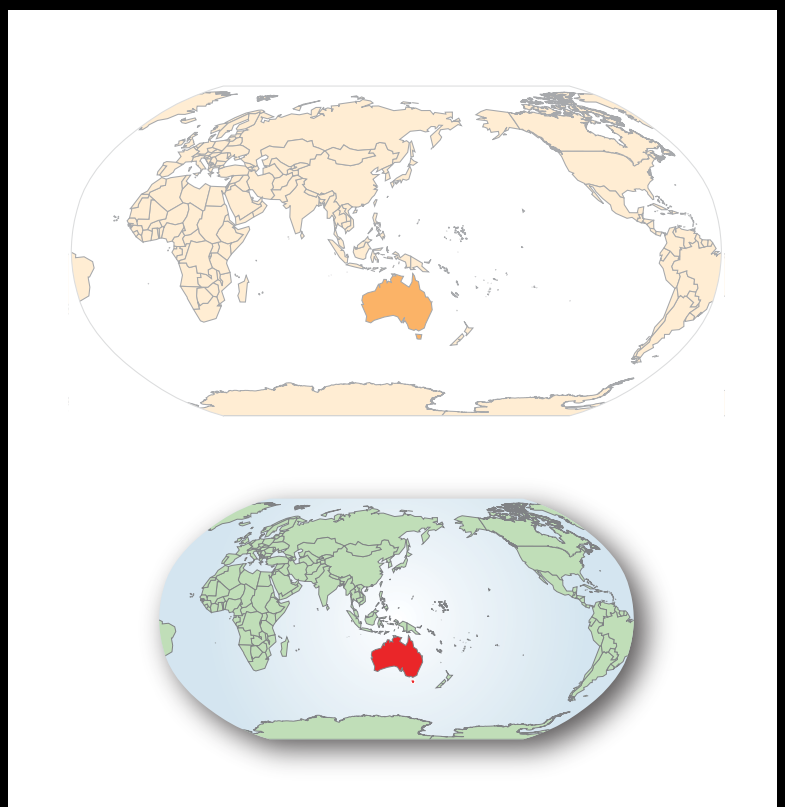
Final printed file

The Spectrum of Manuscript - Now we're talking!!

.nb Files Save Time, Cost, and Reduces Introduced Errors



.nb file as manuscript

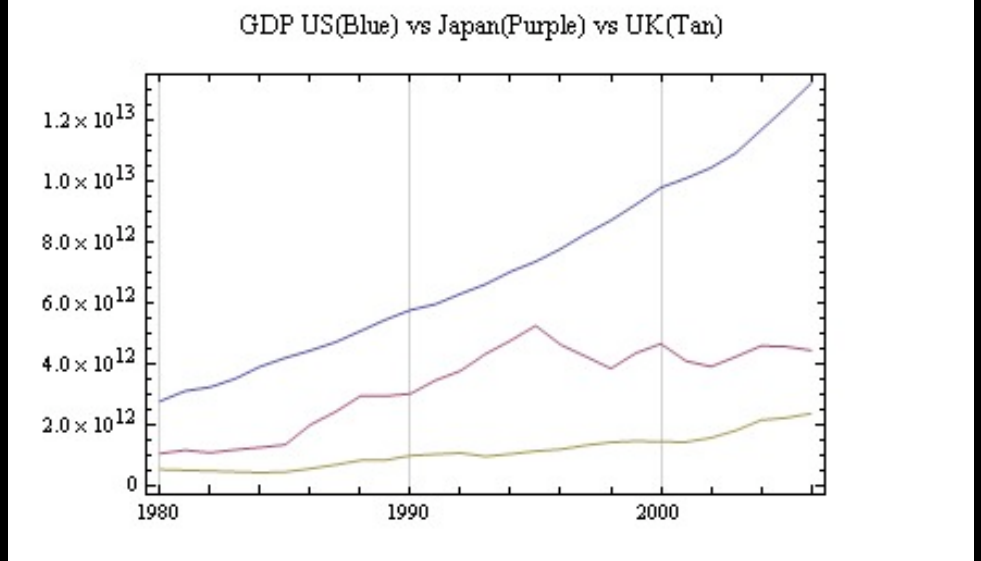


Illustrator final file
Top: original .eps from .nb file
Bottom: Book styles/sizing applied

Case Studies - How do we work with .nb files?

Case Study One - Using *Mathematica* for 2D content

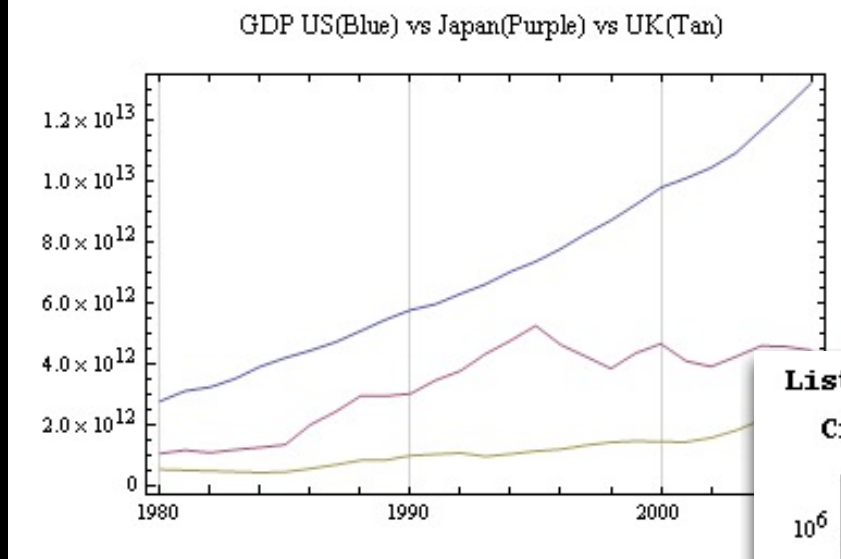
```
data1 = CountryData["UnitedStates", {{"GDP"}, {1980, 2008}}];
data2 = CountryData["Japan", {{"GDP"}, {1980, 2008}}];
data3 = CountryData["UnitedKingdom", {{"GDP"}, {1980, 2008}}];
DateListPlot[{data1, data2, data3}, Joined → True,
 PlotLabel → "GDP US(Blue) vs Japan(Purple) vs UK(Tan)"]
```



.nb file showing line graph and scatter plot data for two illustrations

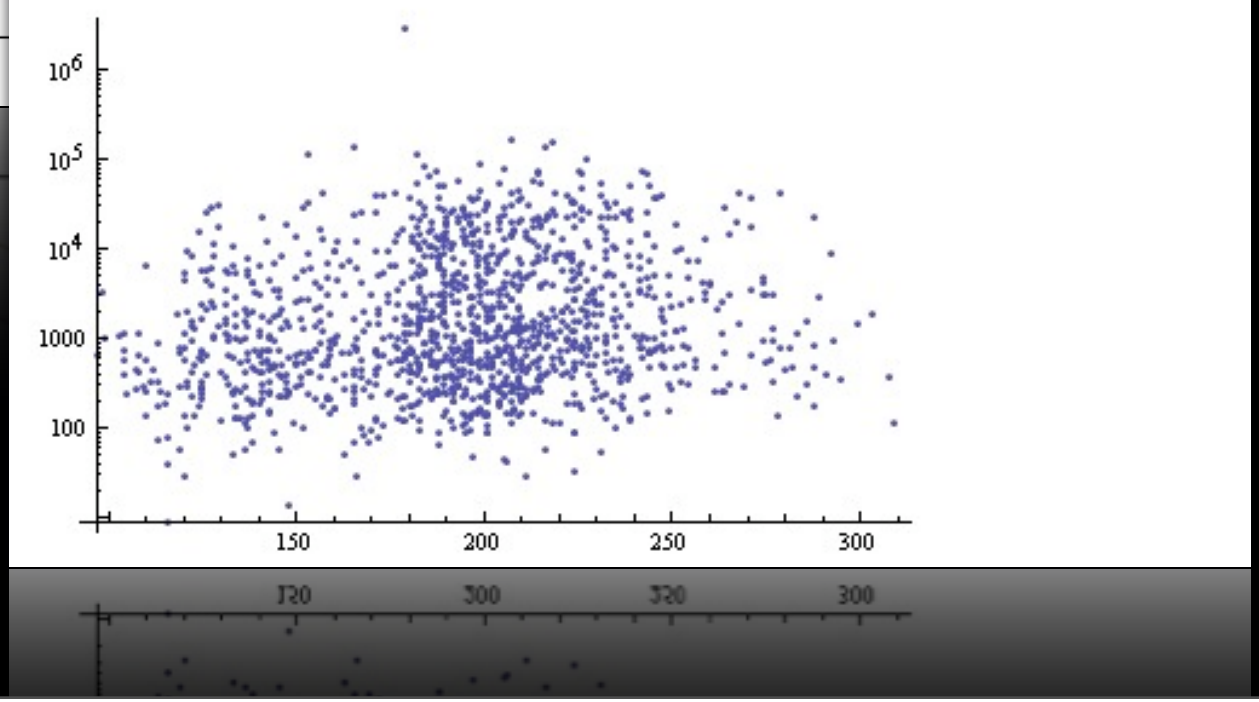
Case Study One - Using *Mathematica* for 2D content

```
data1 = CountryData["UnitedStates", {{"GDP"}, {1980, 2008}}];
data2 = CountryData["Japan", {{"GDP"}, {1980, 2008}}];
data3 = CountryData["UnitedKingdom", {{"GDP"}, {1980, 2008}}];
DateListPlot[{data1, data2, data3}, Joined → True,
 PlotLabel → "GDP US(Blue) vs Japan(Purple) vs UK(Tan)"]
```

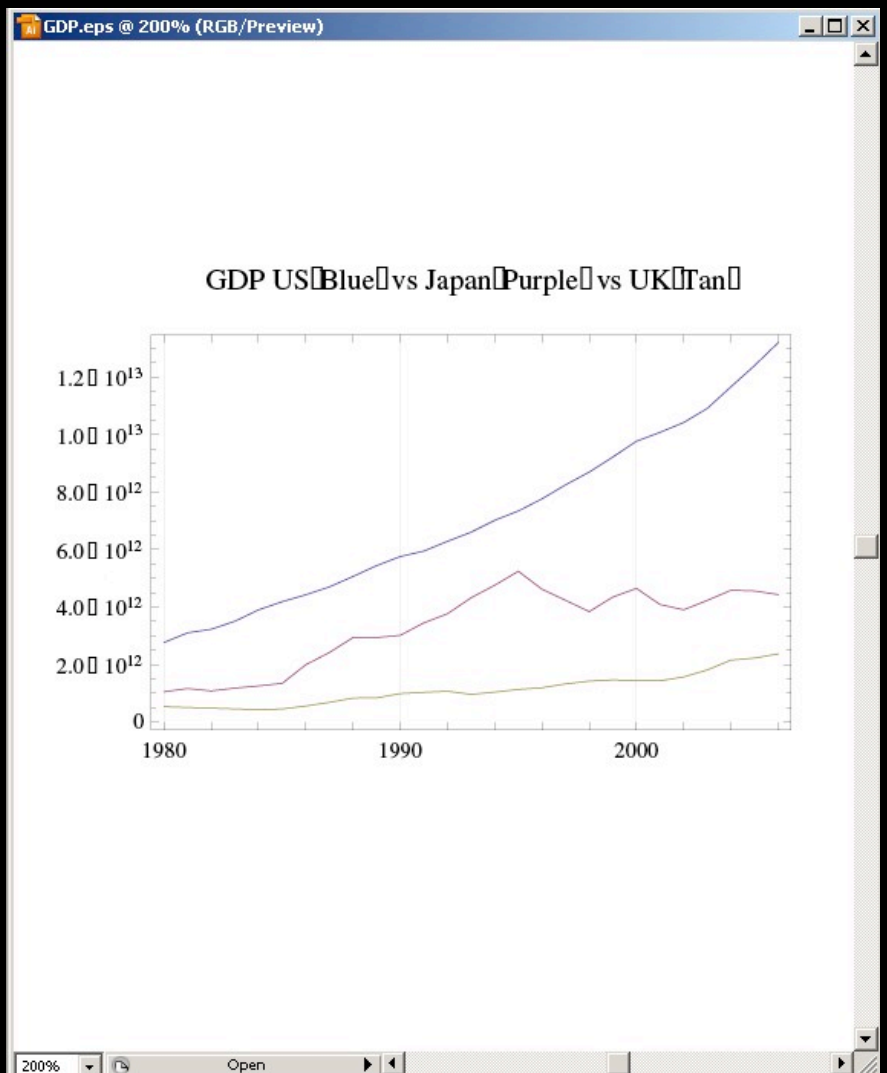


.nb file showing line graph and scatter plot data for two illustrations

```
ListLogPlot[{CityData[#, "Elevation"], CityData[#, "Population"]} & /@
  CityData[{All, "Illinois", "UnitedStates"}]]
```



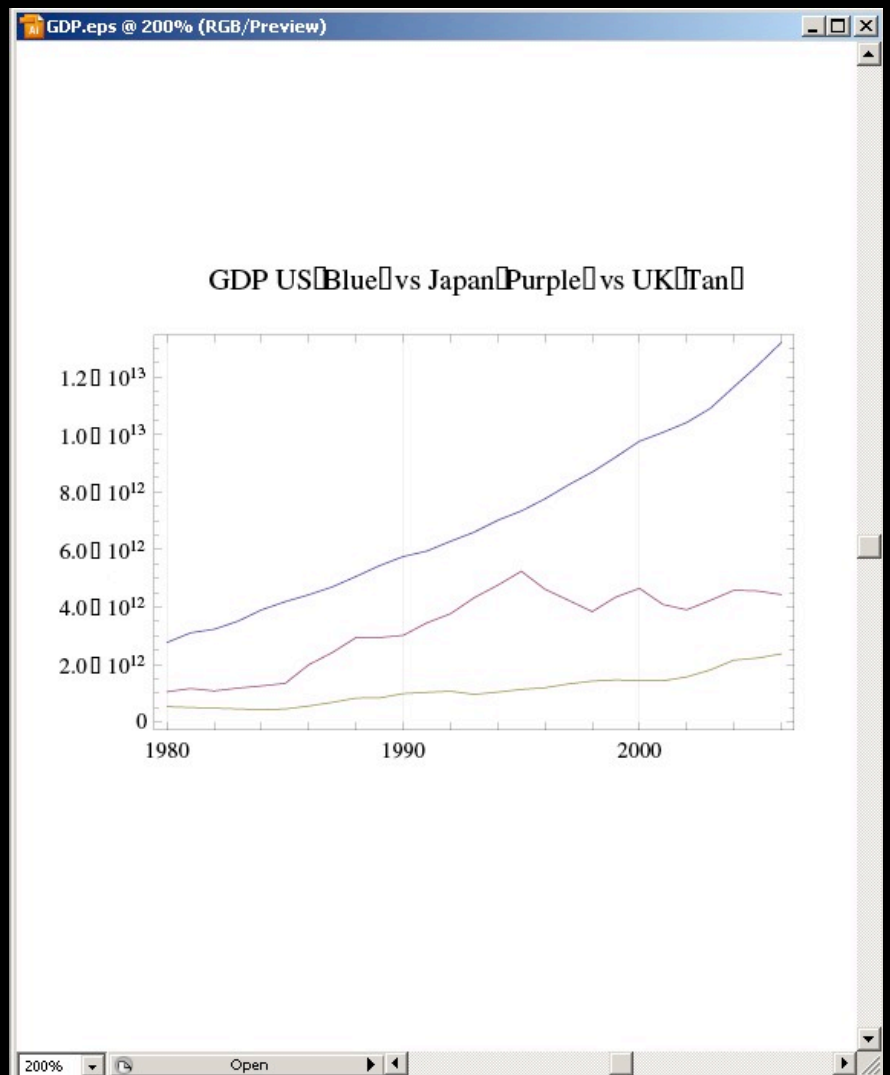
Case Study One - Using *Mathematica* for 2D content



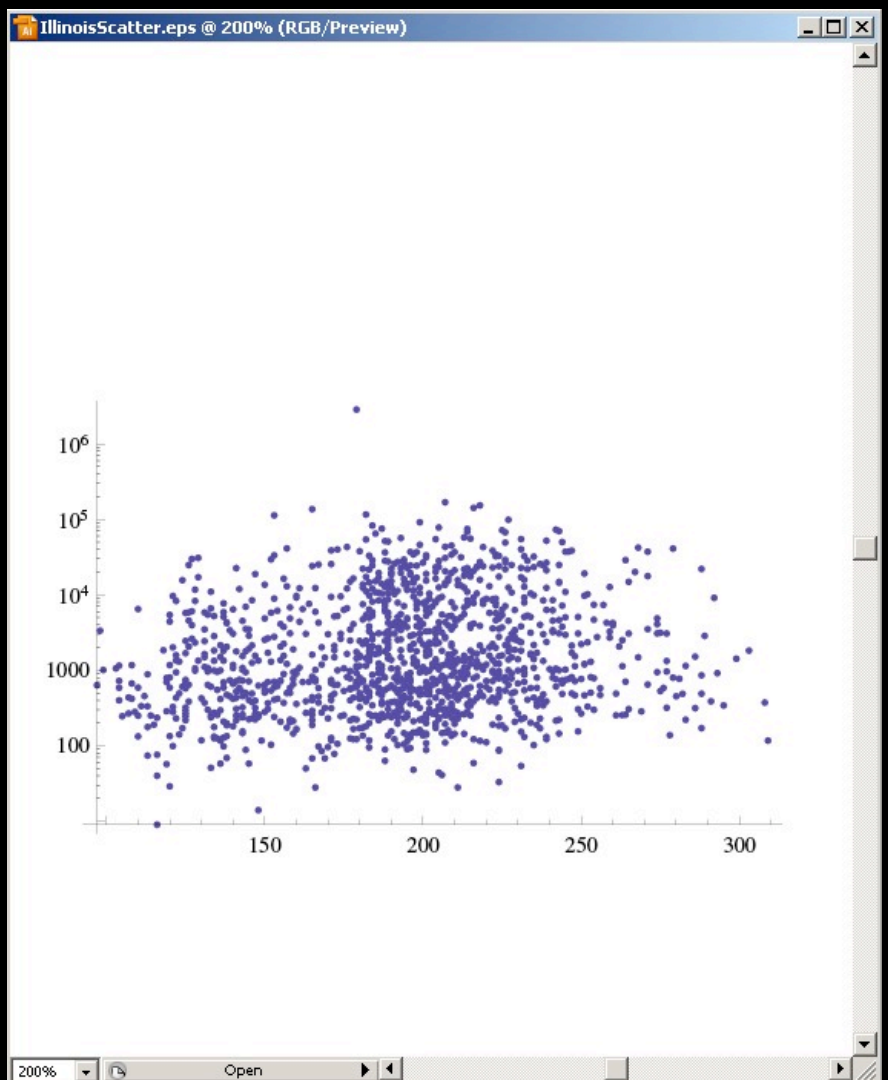
.nb data exported as .eps directly into Illustrator.

Content of the file is easy to manipulate and adjust to book styling

Case Study One - Using *Mathematica* for 2D content

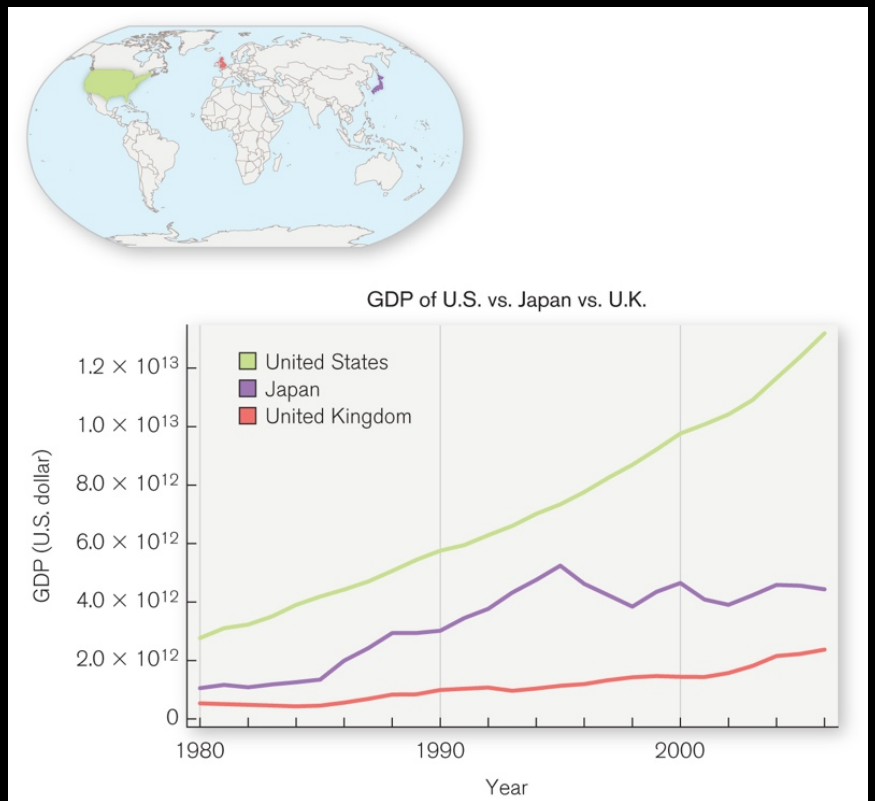


.nb data exported as .eps directly into Illustrator.



Content of the file is easy to manipulate and adjust to book styling

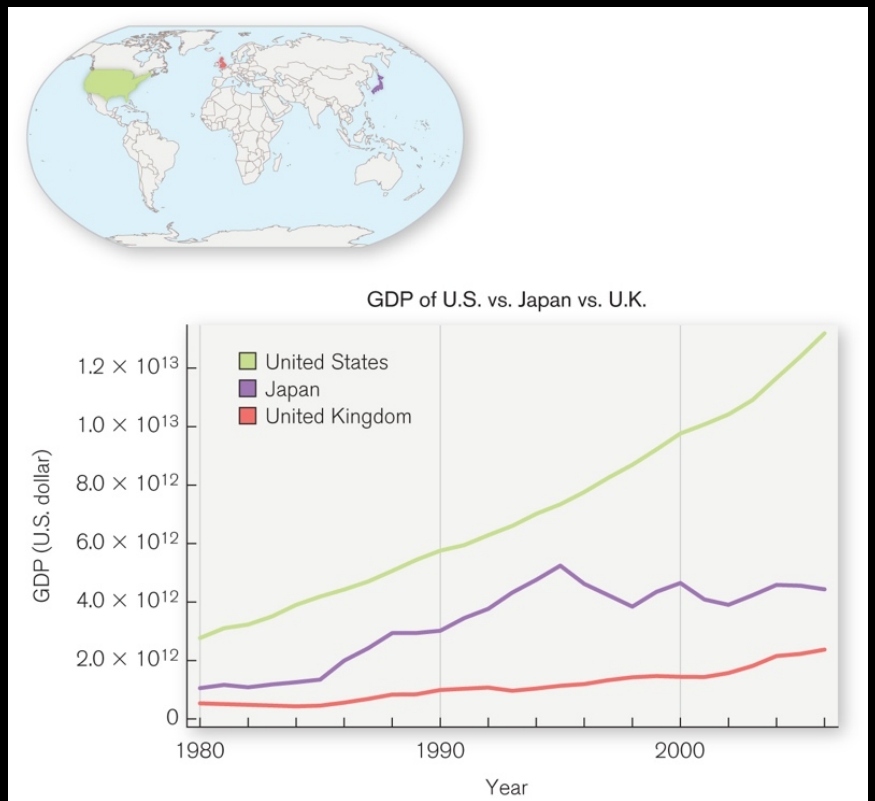
Case Study One - Using *Mathematica* for 2D content



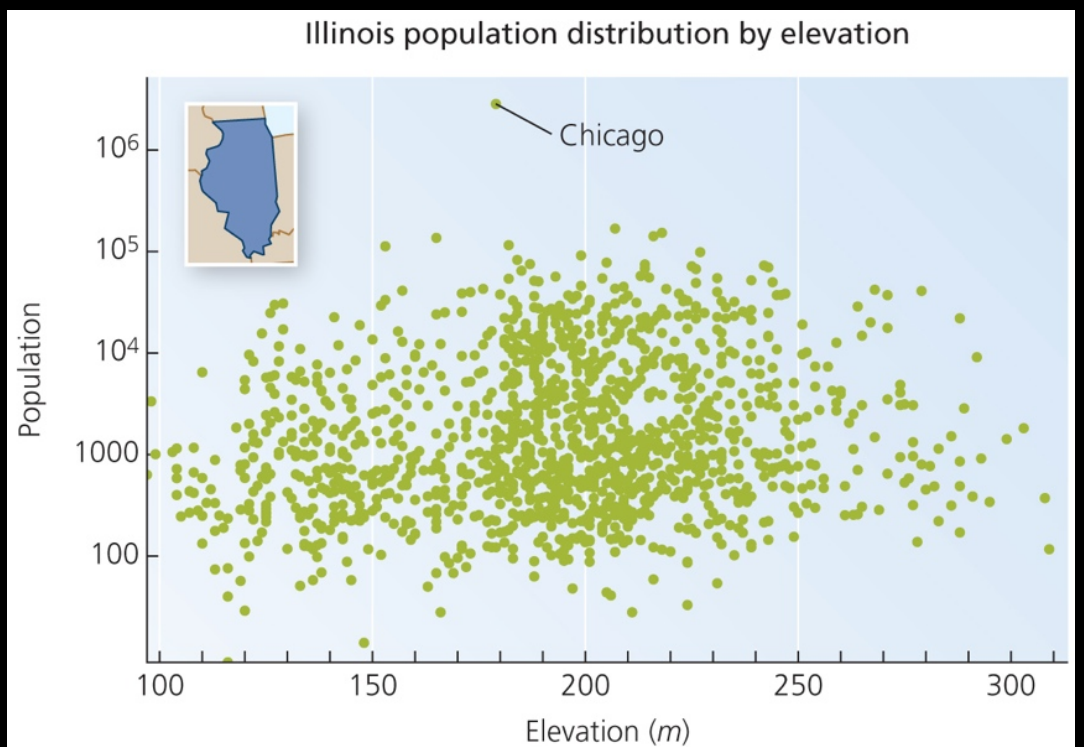
Final images as seen in print

Accuracy was maintained and time was saved not having to redraw data!

Case Study One - Using *Mathematica* for 2D content

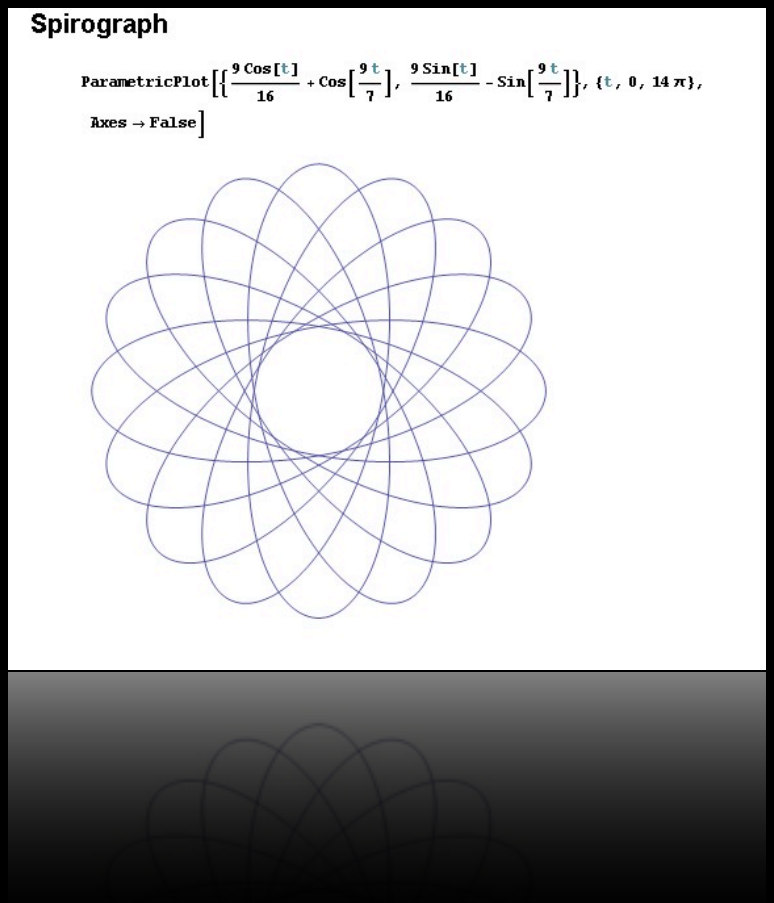


Final images as seen in print



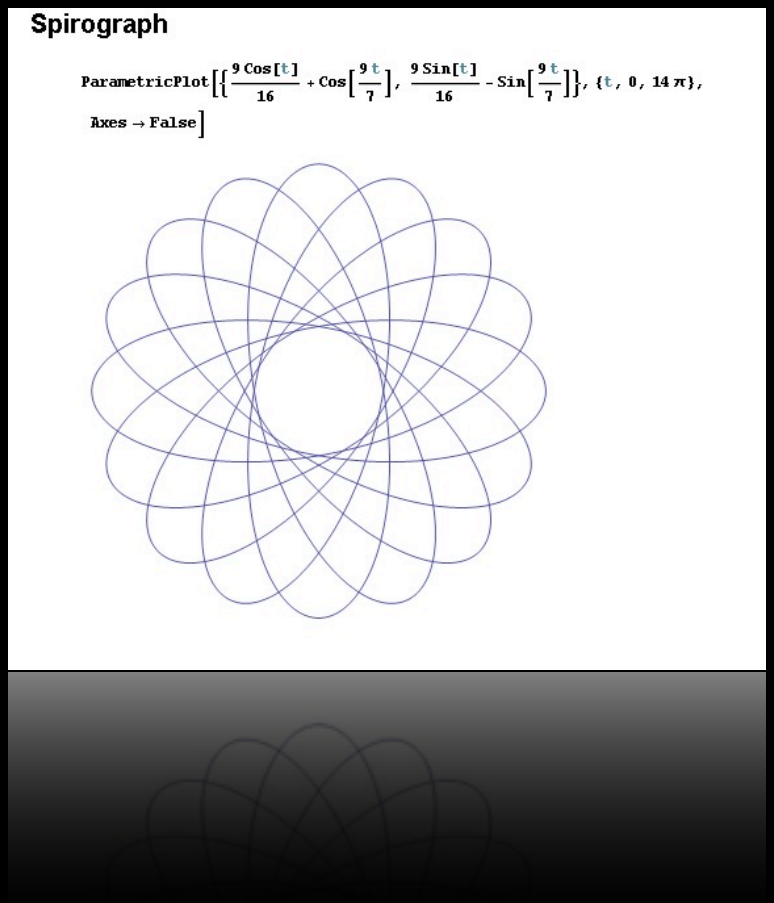
Accuracy was maintained and time was saved not having to redraw data!

Case Study Two - *Mathematica* to define motion path

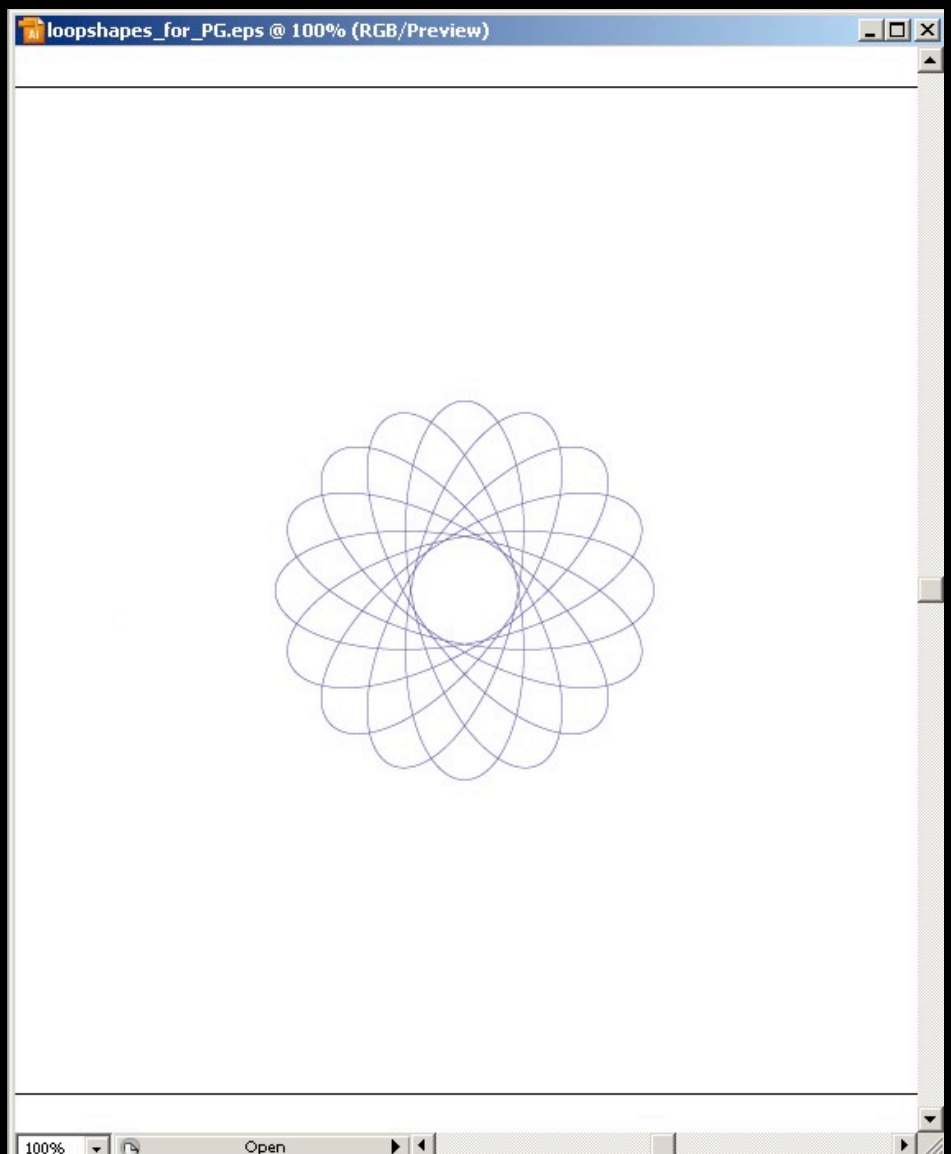


.nb file showing equation and path for pendulum motion.

Case Study Two - *Mathematica* to define motion path



.nb file showing equation and path for pendulum motion.

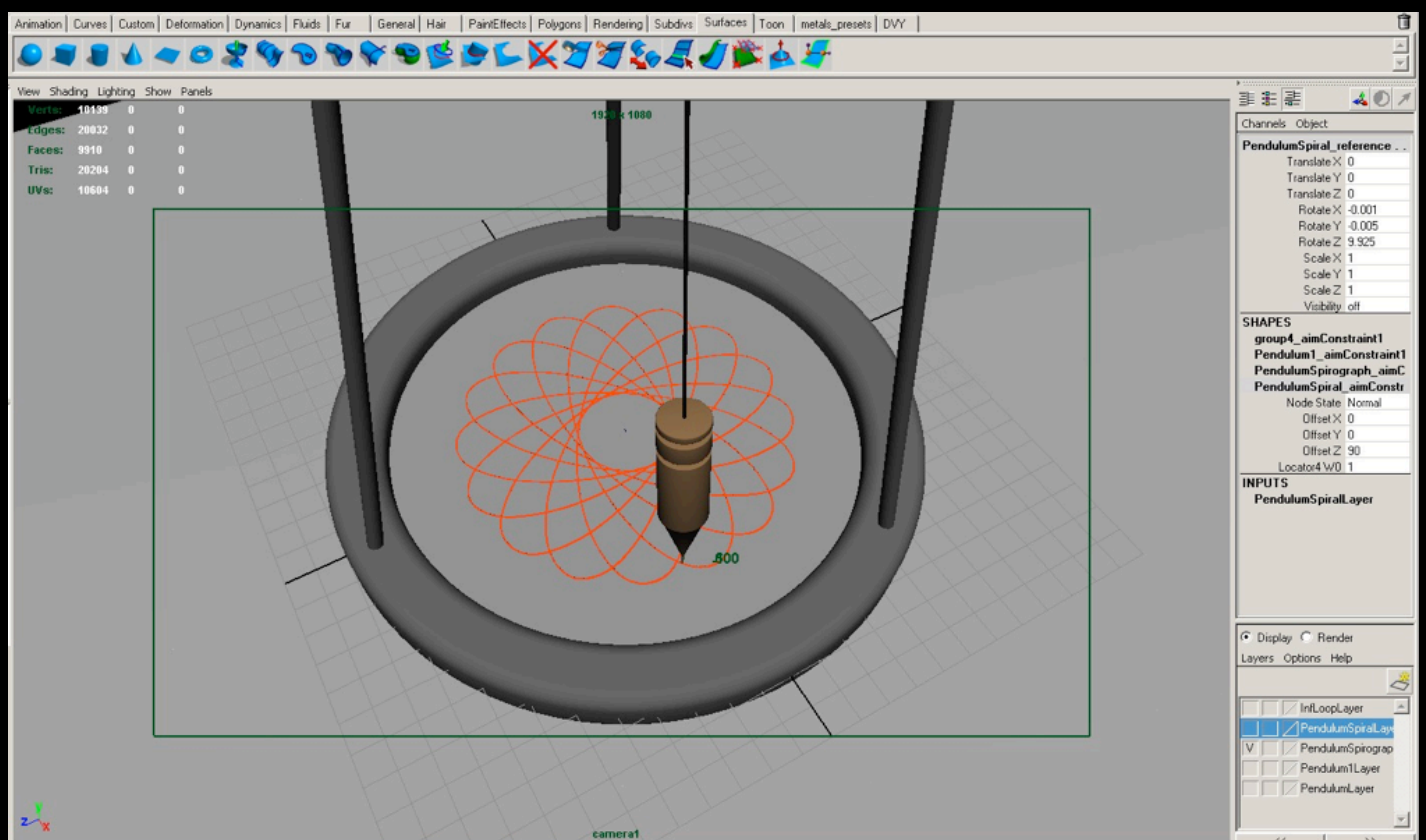


.nb file is imported into Illustrator to be used by Maya as the motion pathway for the final animation.

Case Study Two - Using *Mathematica* to dictate motion

Maya view showing motion plot from *Mathematica*

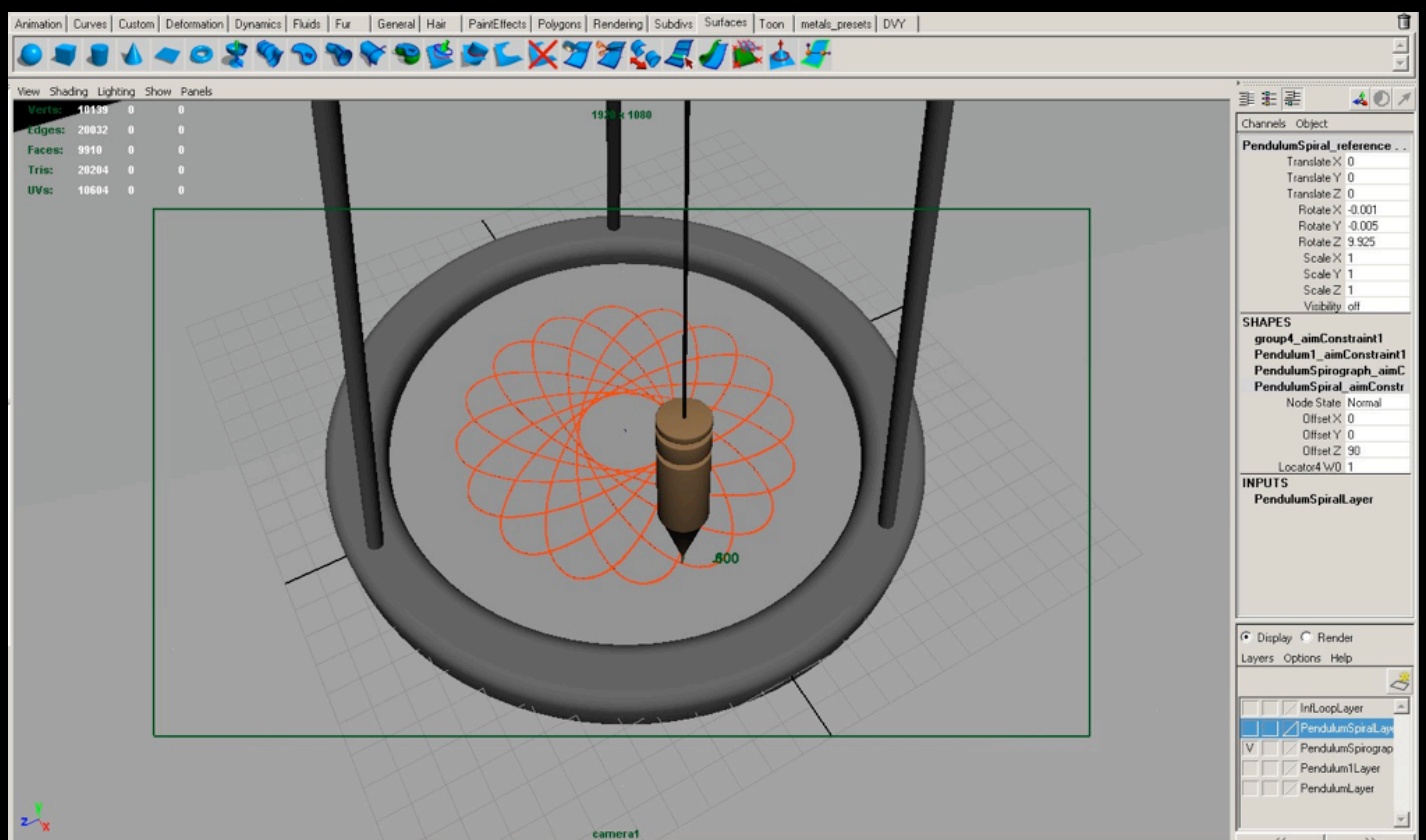
Mathematica provided Maya with an equation based pathway for it to trace.



Case Study Two - Using *Mathematica* to dictate motion

Maya view showing motion plot from *Mathematica*

Mathematica provided Maya with an equation based pathway for it to trace.



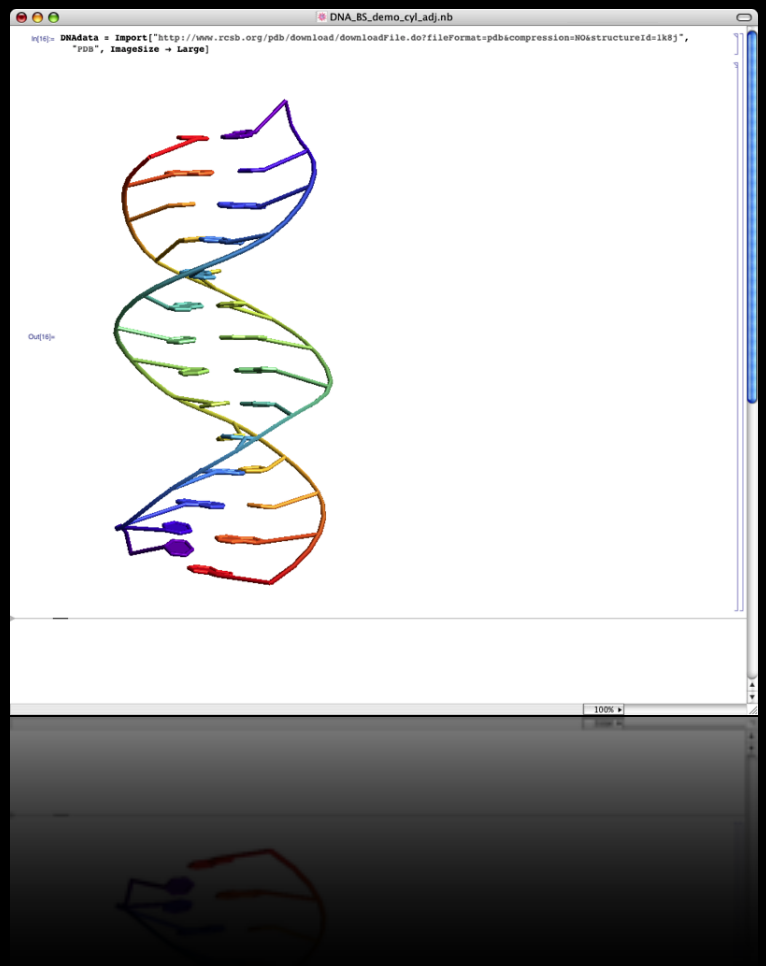
This workflow saved time in processing and allowed Maya to avoid complex calculations.

Case Study Two - Using *Mathematica* to dictate motion

$$f_x(t) = \frac{9\cos(t)}{16} + \cos(\frac{9t}{7})$$
$$f_y(t) = \frac{9\sin(t)}{16} - \sin(\frac{9t}{7})$$

Final animation in Maya

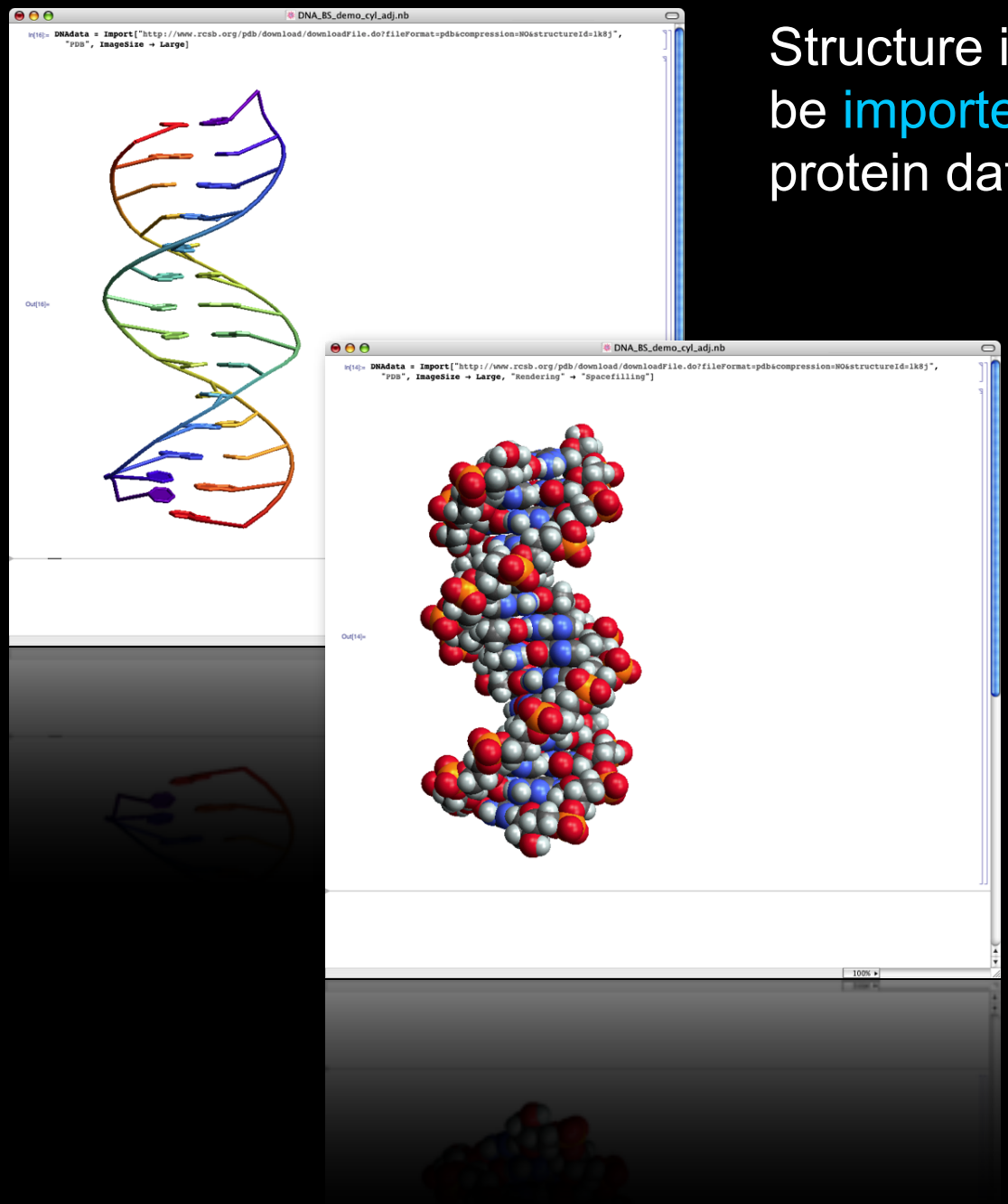
Case Study Three - Using *Mathematica* for 3D Content



Structure information of DNA can be imported directly from the online protein databank in *Mathematica*.

The default is a ribbon-like structure. By changing the **“Rendering”** option, spacefilling and ball and stick models are available.

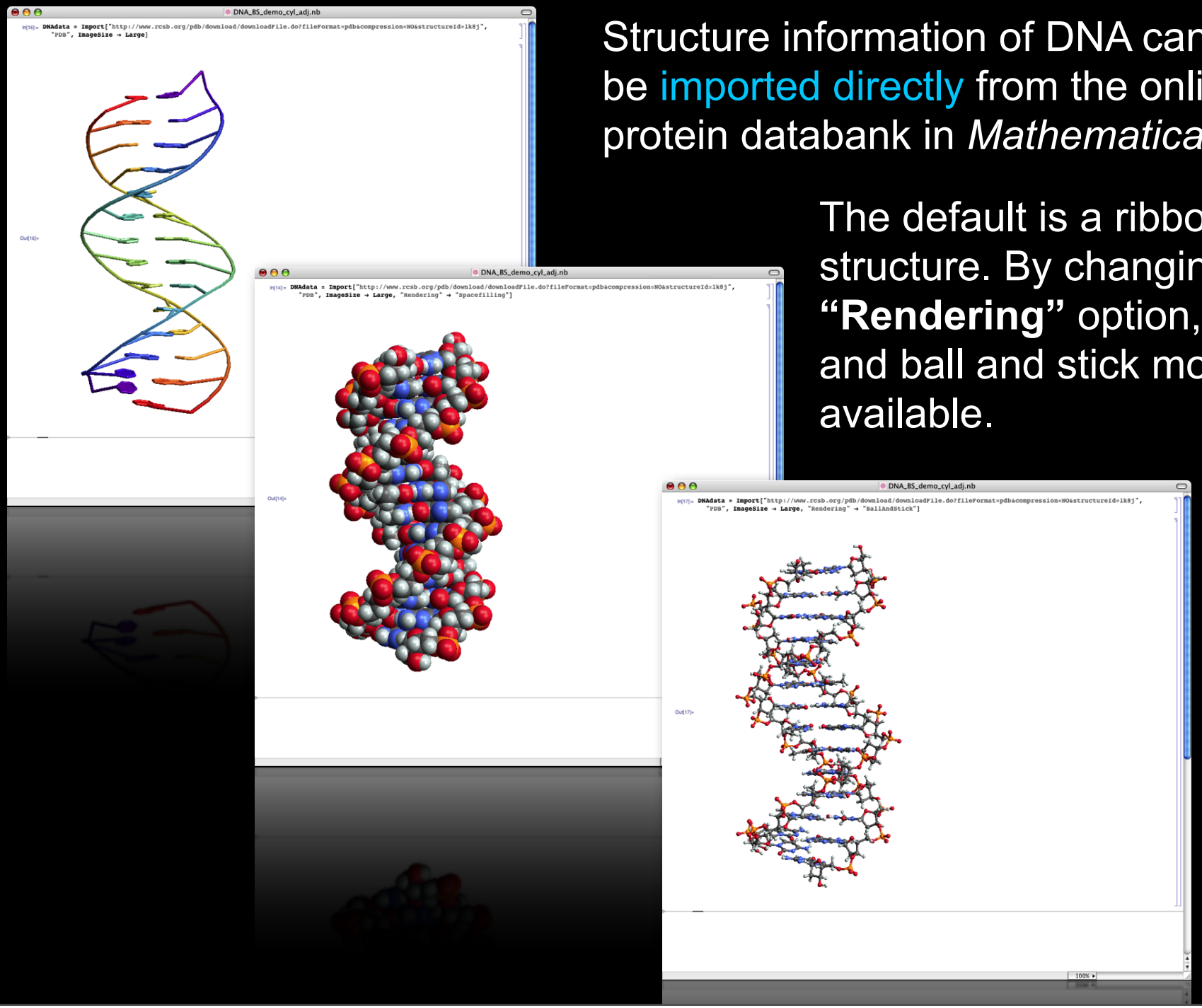
Case Study Three - Using *Mathematica* for 3D Content



Structure information of DNA can be imported directly from the online protein databank in *Mathematica*.

The default is a ribbon-like structure. By changing the **“Rendering”** option, spacefilling and ball and stick models are available.

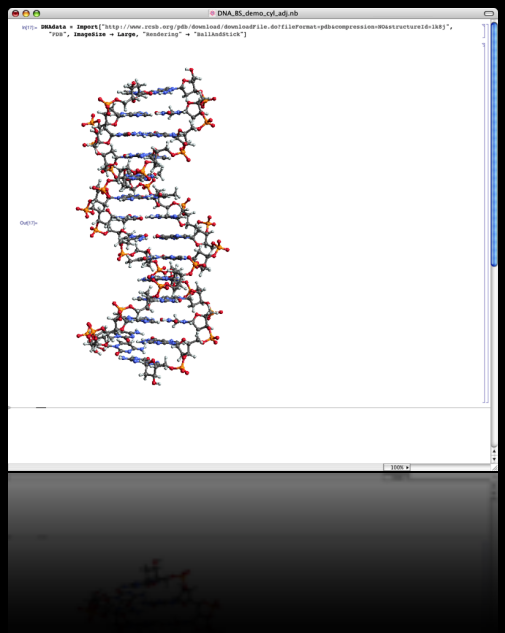
Case Study Three - Using *Mathematica* for 3D Content



Structure information of DNA can be imported directly from the online protein databank in *Mathematica*.

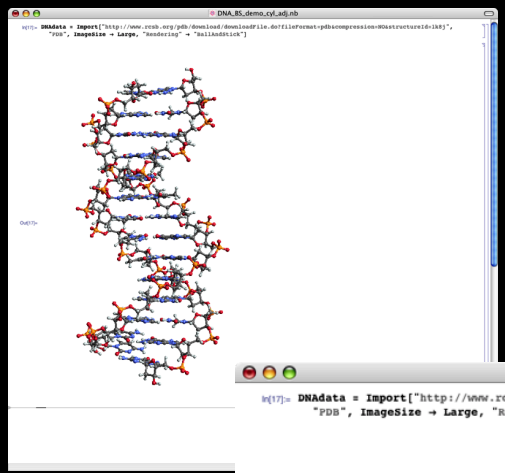
The default is a ribbon-like structure. By changing the **“Rendering”** option, spacefilling and ball and stick models are available.

Case Study Three - Using *Mathematica* for 3D Content

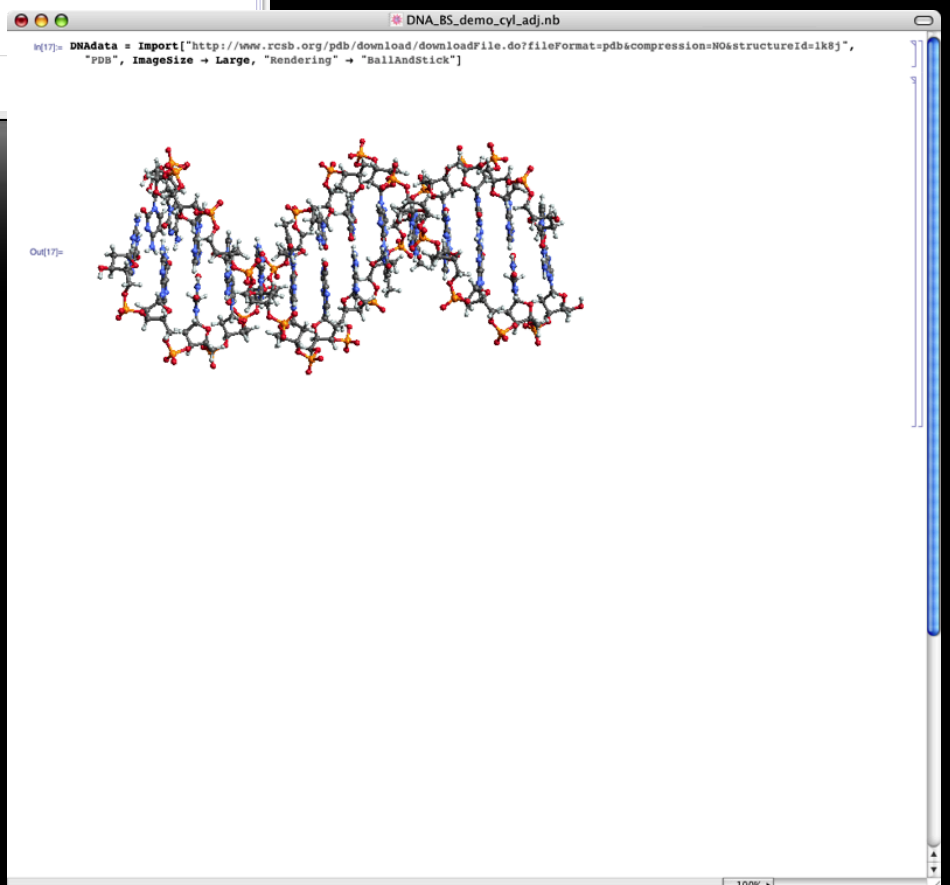


Ball and stick from
Mathematica .nb file

Case Study Three - Using *Mathematica* for 3D Content

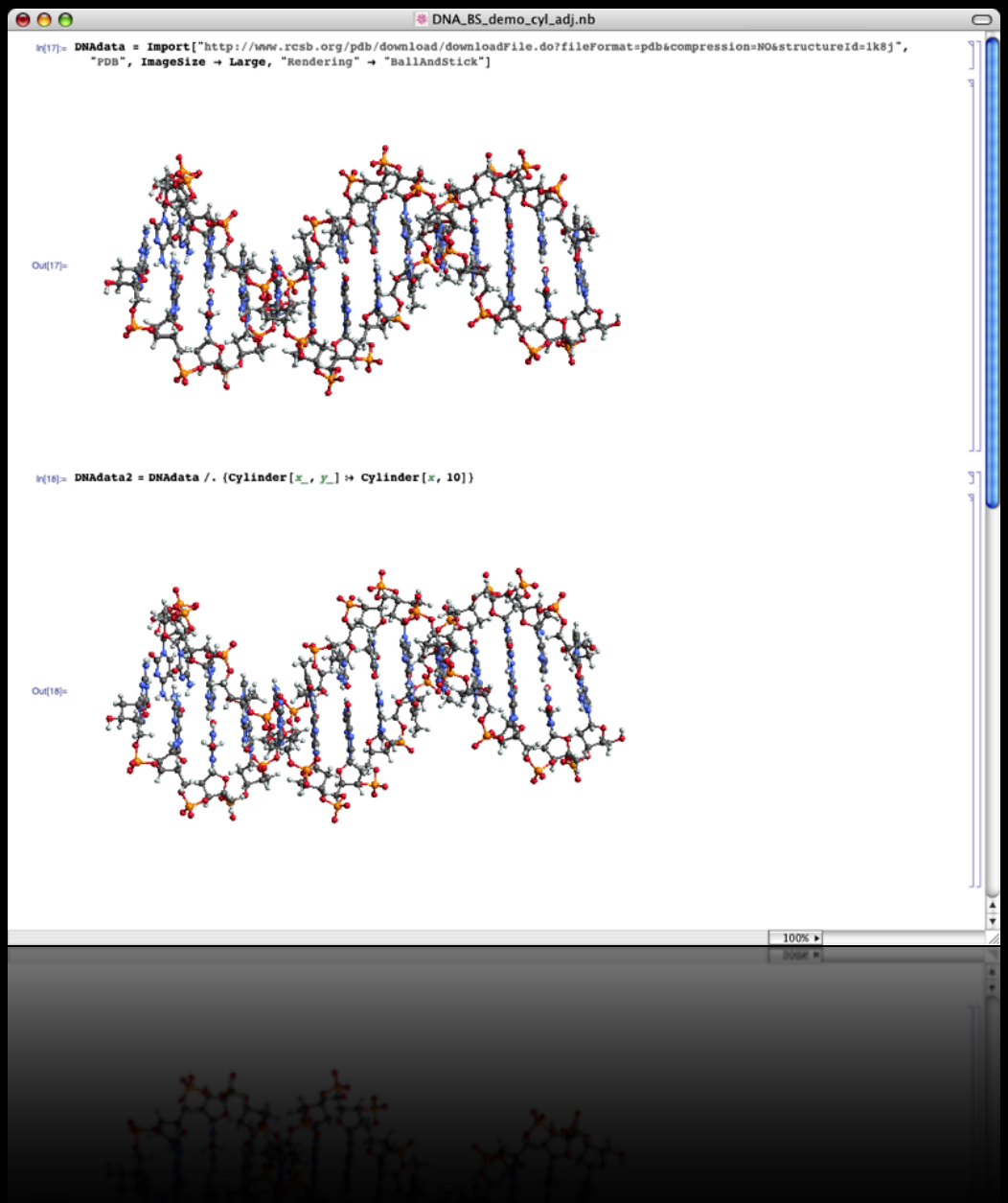


Ball and stick from *Mathematica* .nb file



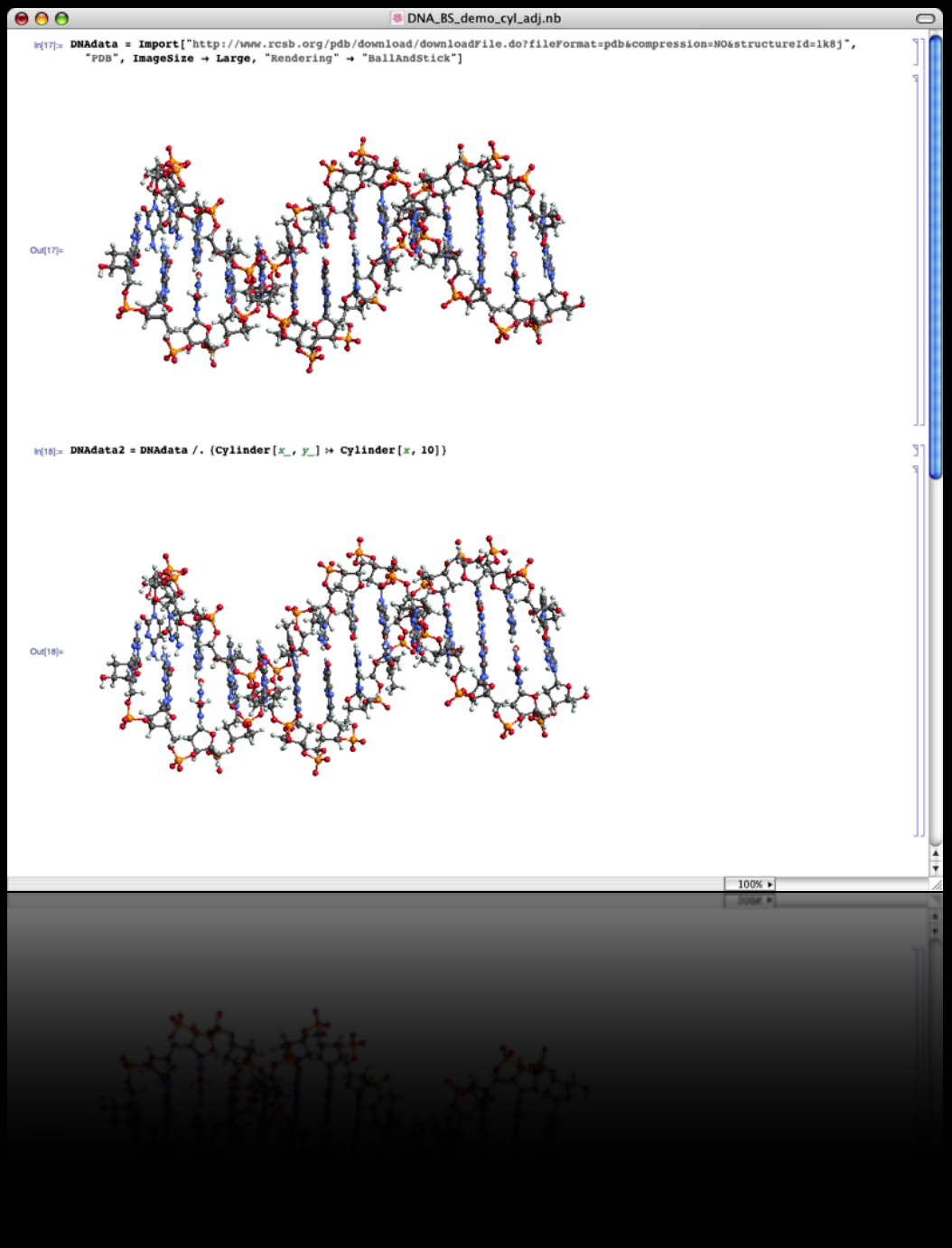
Adjusting orientation within .nb file. You can ensure that the information is presented exactly according to your specifications because you placed it yourself.

Case Study Three - Using *Mathematica* for 3D Content



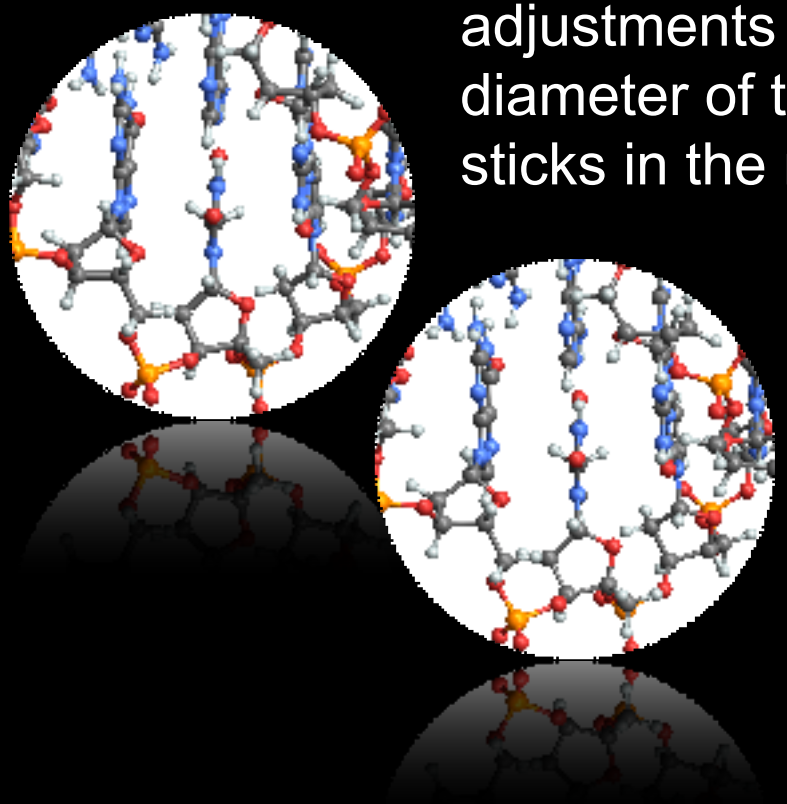
Content owner has control over many details. Make any final adjustments to the data, while it's all still stored in *Mathematica* and can be easily adjusted.

Case Study Three - Using *Mathematica* for 3D Content

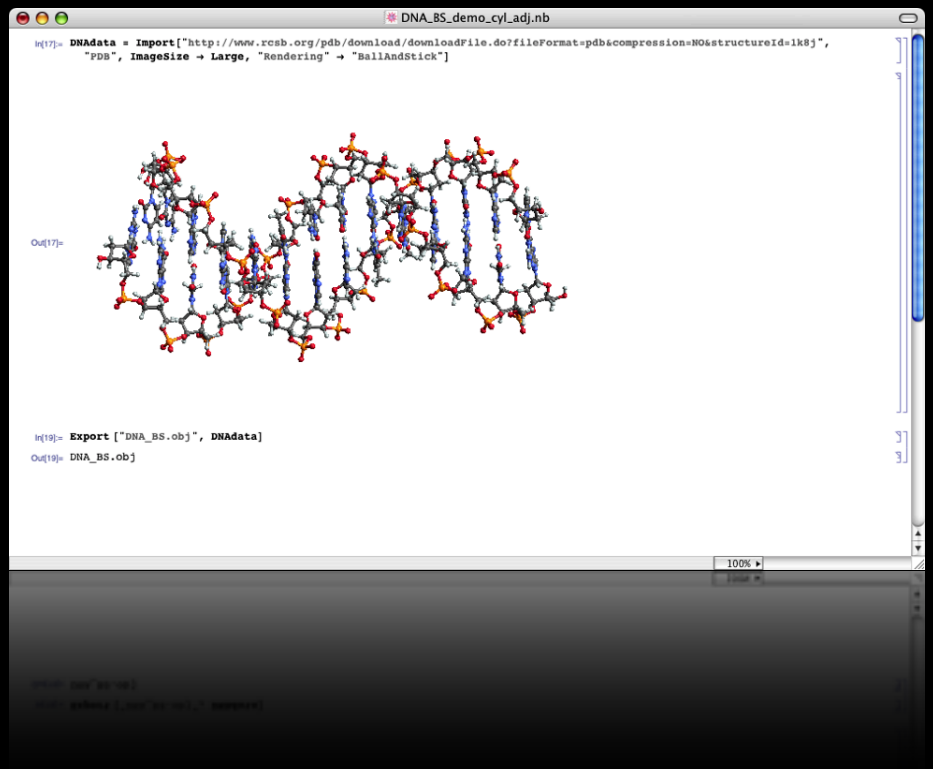


Content owner has control over many details. Make any final adjustments to the data, while it's all still stored in *Mathematica* and can be easily adjusted.

This shows subtle adjustments to the diameter of the sticks in the model

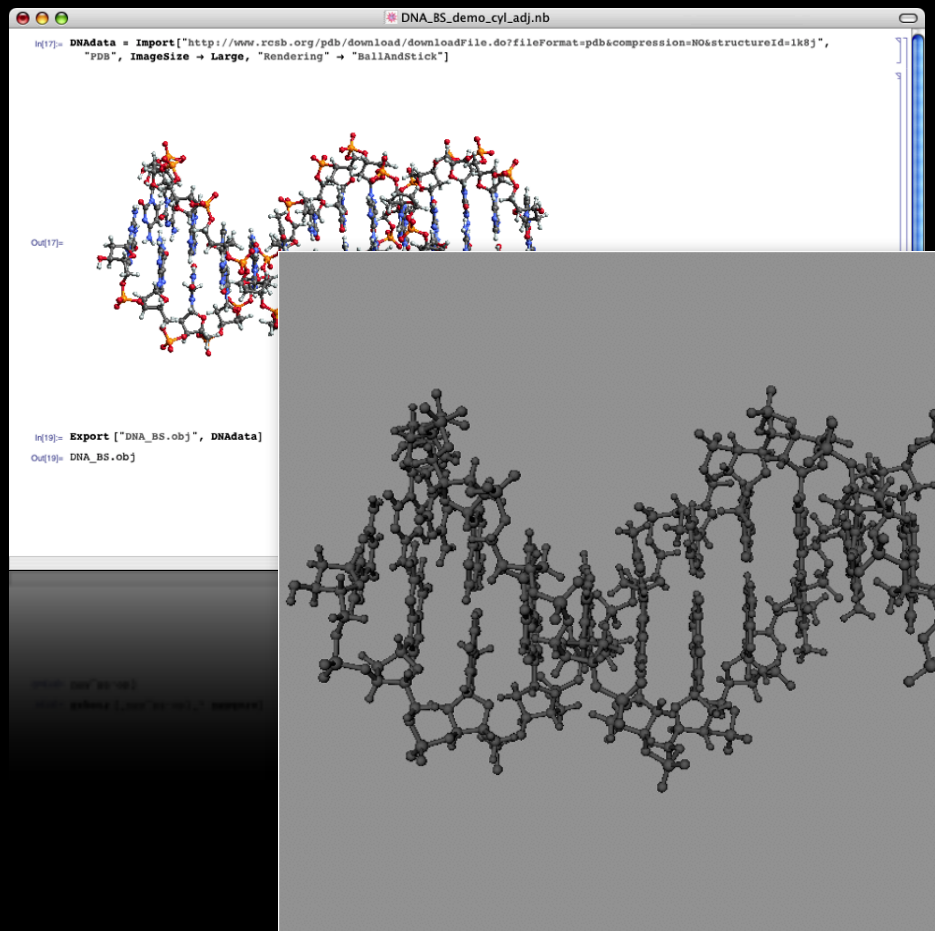


Case Study Three - Using *Mathematica* for 3D Content



Exporting image as an .obj file. Image to be imported by Maya.

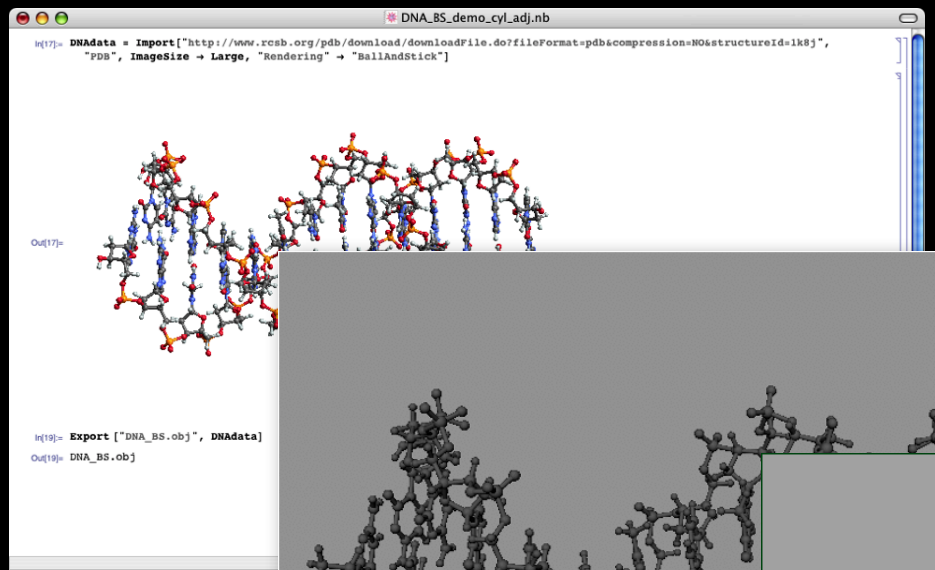
Case Study Three - Using *Mathematica* for 3D Content



Exporting image as an .obj file. Image to be imported by Maya.

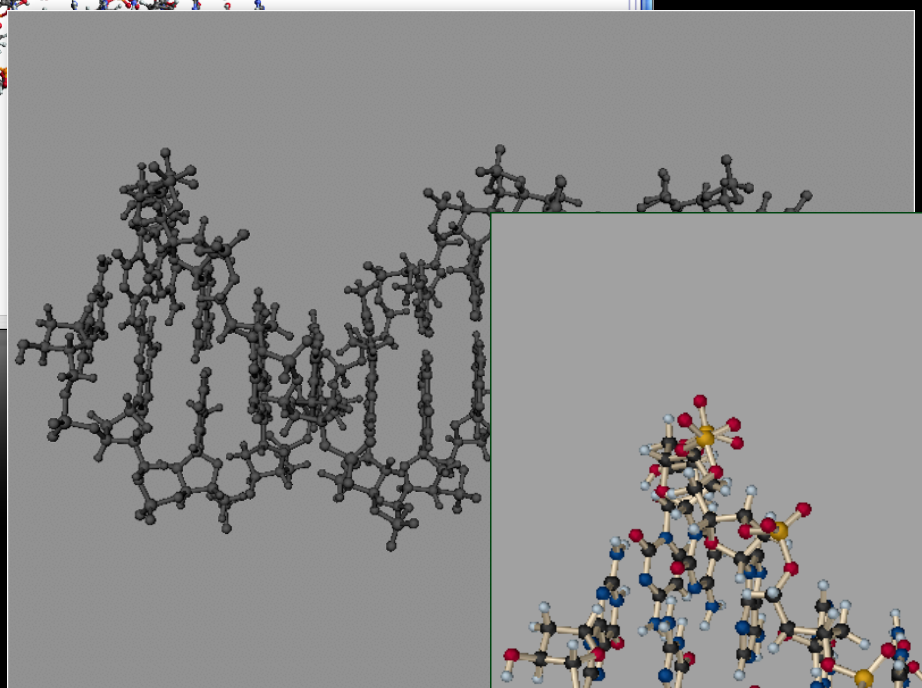
Image as imported by Maya

Case Study Three - Using *Mathematica* for 3D Content



Exporting image as an .obj file. Image to be imported by Maya.

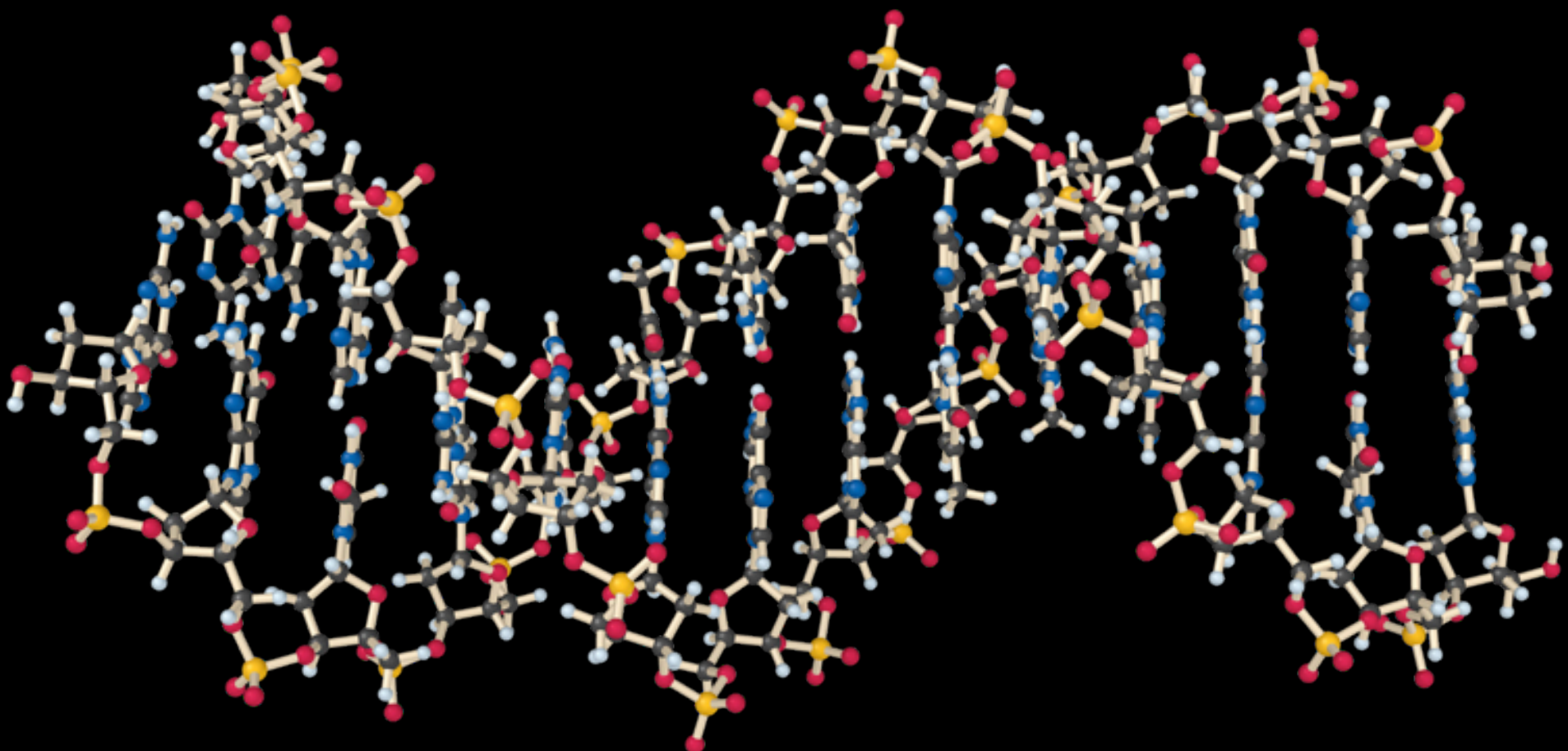
Image as imported by Maya



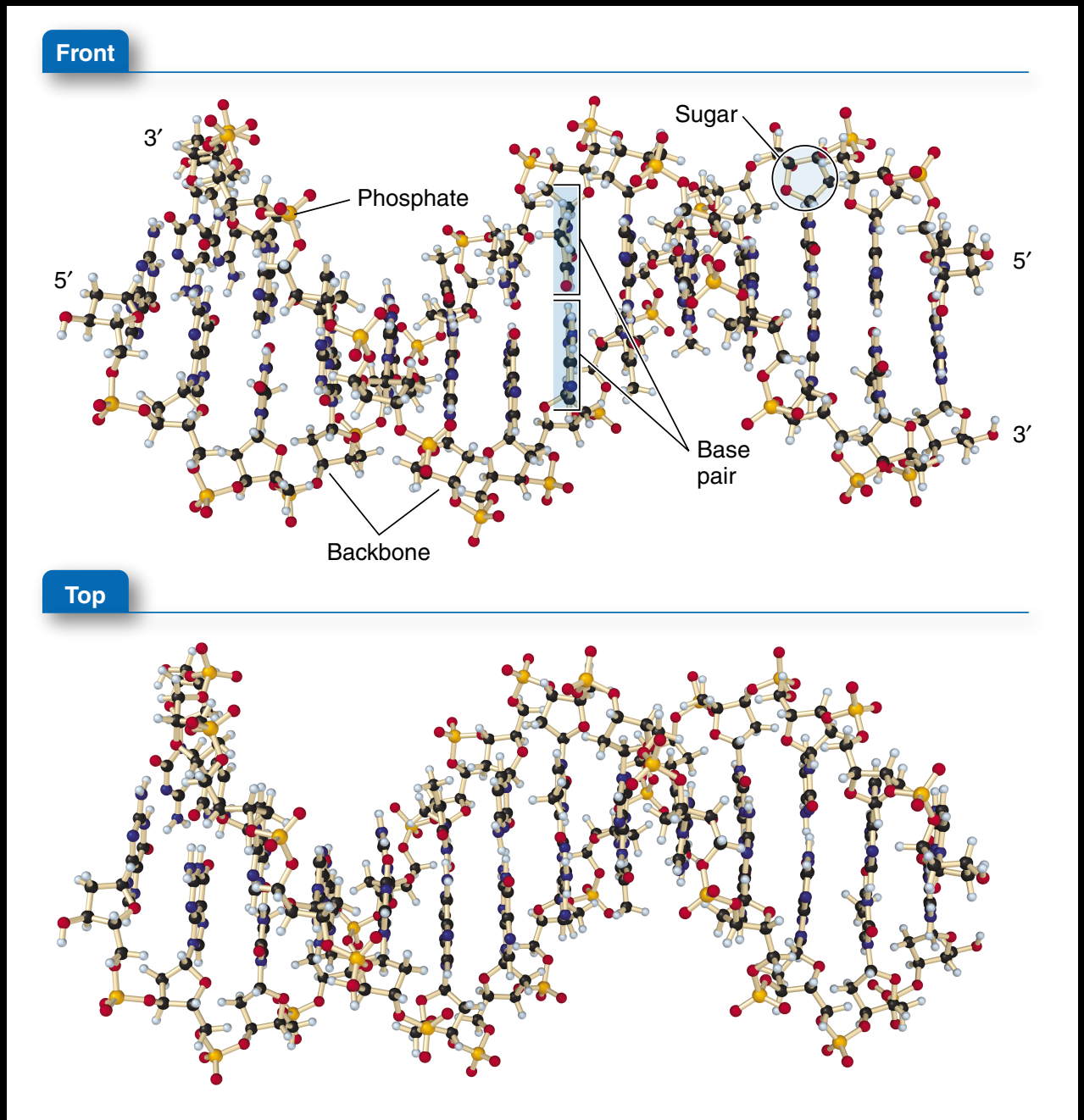
Color and shading added in Maya

Case Study Three - Using *Mathematica* for 3D Content

Rendering image in Maya for use in print once color and texturing are set up in book style.



Case Study Three - Using *Mathematica* for 3D Content

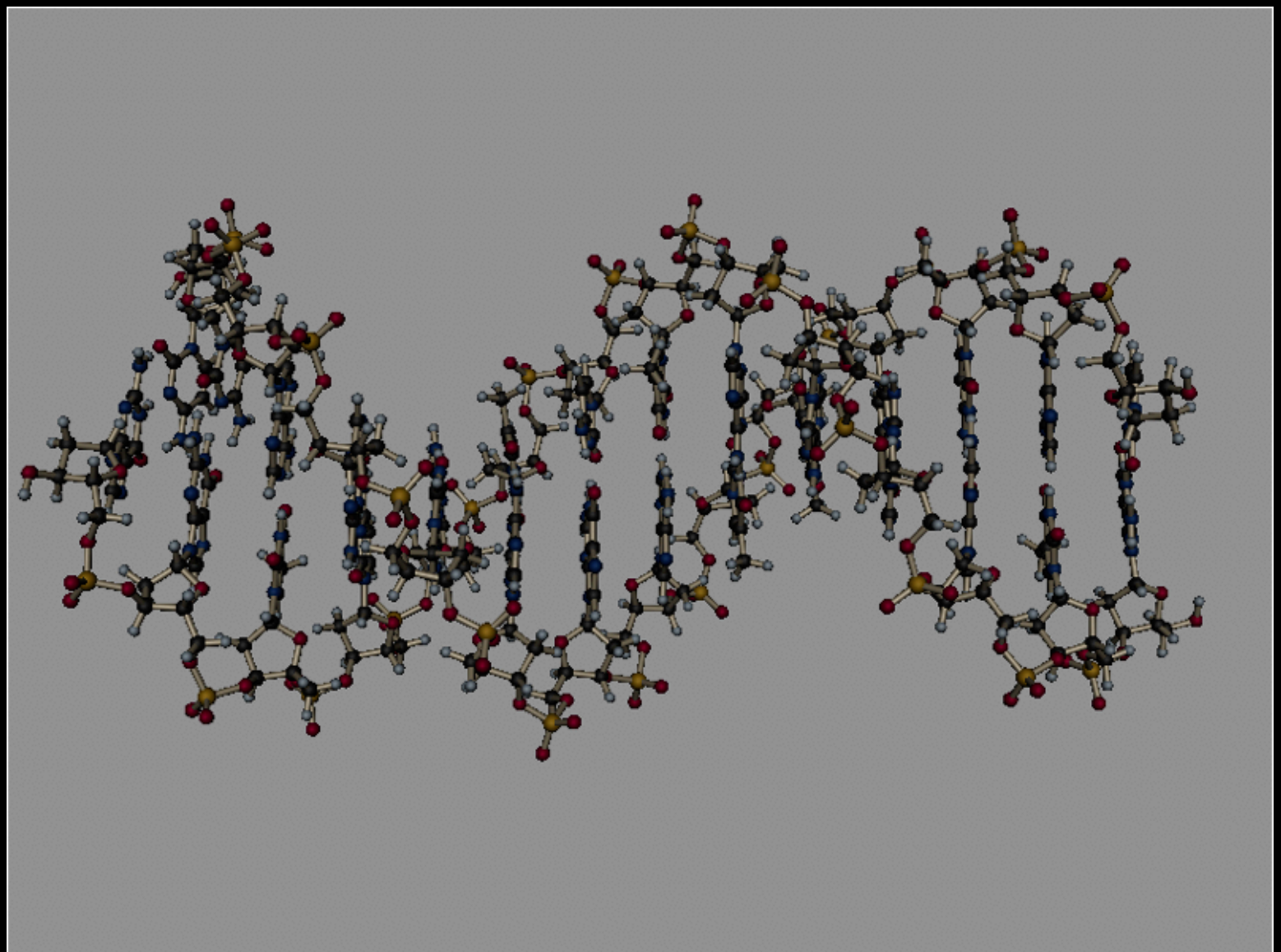


Final printed image

Stills of 3D image pulled out of *Maya* and adjusted in Photoshop and Illustrator. File is ready for print.

Case Study Three - Using *Mathematica* for 3D Content

Rendering image in Maya for animation once color and texturing are set up in book style.



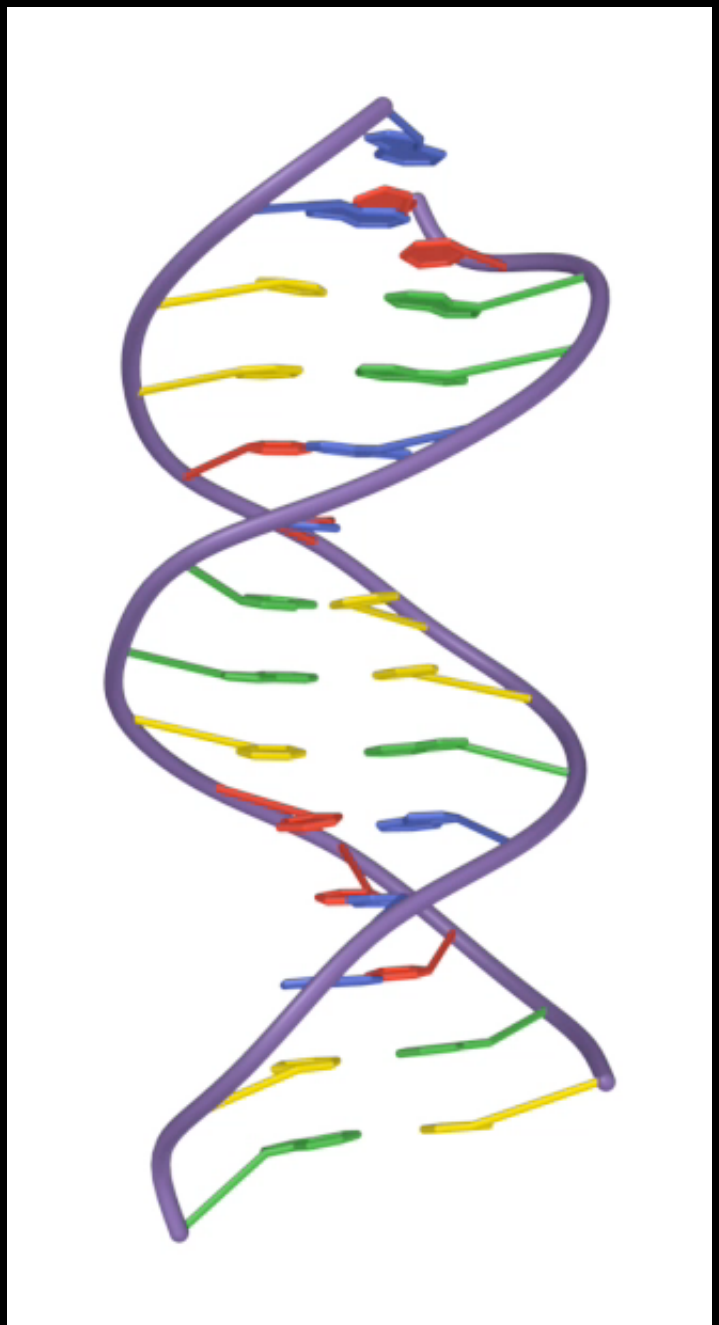
Case Study Three - Using *Mathematica* for 3D Content

Case Study Three - Using *Mathematica* for 3D Content

Animation to accompany print image

Data for all structures were pulled out of *Mathematica*, adjusted to book styles and animated in Maya.

Case Study Three - Using *Mathematica* for 3D Content



Animation to accompany print image

Data for all structures were pulled out of *Mathematica*, adjusted to book styles and animated in Maya.

Thank you

PRECISION GRAPHICS

www.precisiongraphics.com

For more information contact:

Jan Troutt
Vice President
217.359.6655
jtroutt@precisiongraphics.com