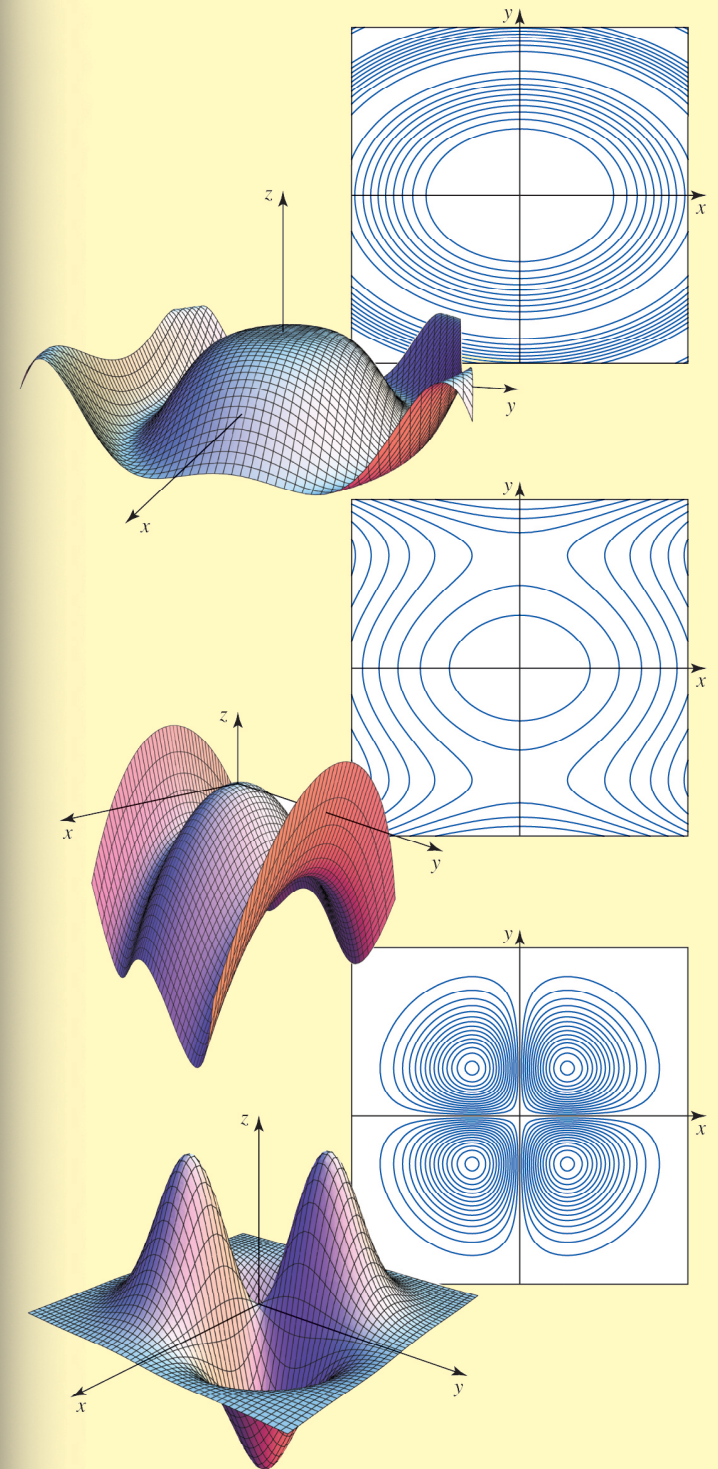
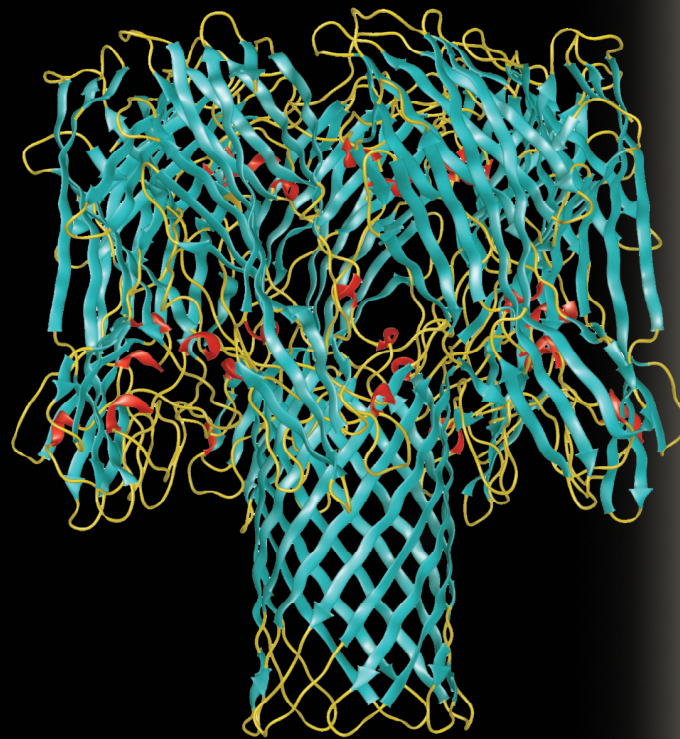


From *Mathematica* to Manuscript: Publishing and Preparation of Scientific Content

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
105 South Neil Street, Champaign, Illinois 61820 VOICE: 217.259.8600 FAX: 217.288.3027 EMAIL: info@precisiongraphics.com

Axis spacing around the origin:

- Case I: No axis labels
- Case II: Axis labels
- Case III: ONLY horiz. axis labels
- Case IV: Long vert. axis labels

Category I:

- Signs and sub-sets
- Grid plot
- Area plot
- Boundary plot

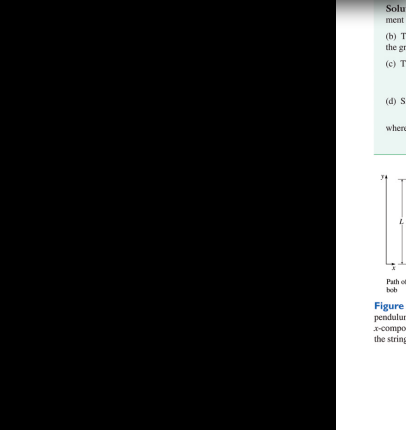
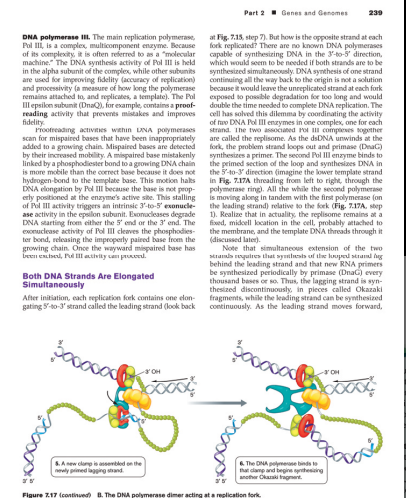
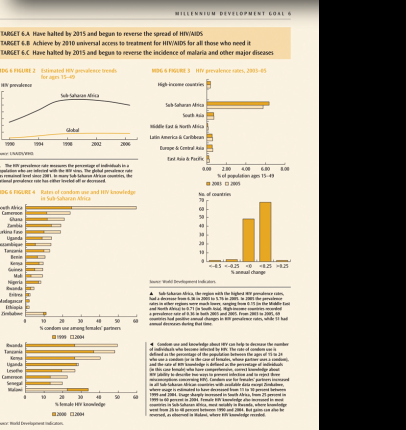
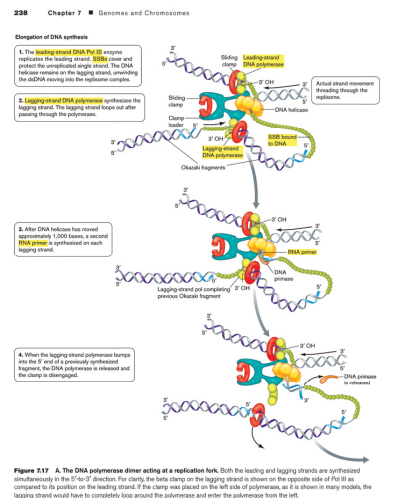
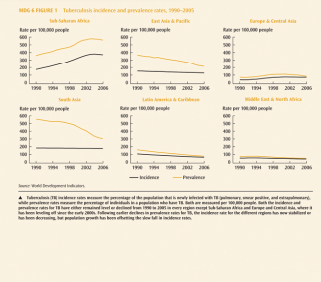
Graphs:

- Plot axes: 5pt, 100% black, #3 arrowheads scaled at 100% of v
- Plot marks: 5pt, 100% black, 6pt long, centered on x,y axes
- Graph grids: 5pt, 30% black
- Extension of y axes at the origin should be consistent with the cases shown above.
- Loaders/arrowhead or dimension arrows: 35pt 100% black, #3 arrowhead scaled at 100% of v
- Point labels: 8pt Times, 100% black, pairs and N character set flush left w/ start, 11pt, space between art and label

Plot rules and tangent lines:

- Plot rules (curves) extending to infinity should extend to the base of the axis arrowheads.
- Plot rules (curves): 3pt 100% color, #3 arrowheads scaled at 100% of v when used.
- Plot rules (curves) and area-fill color order of precedence: color 11, 01, 06, 04, 15, 17 from color palette
- Plot points, with fill: 2.5pt x 2.5pt plot points, 100% color fill (same as curves).
- Plot points, "ungrd": 7.3, 3pt plot points, white fill, 7.5pt 100% stroke (same color as curve)
- Tangent lines on plot rules (curves): 5pt, color 01
- Slope (resultant) rate: 5pt 100% black. If dashed set 4pt dashed/2pt gap.

...Prevalence rates have stabilized since 2001...
...The proportion of population living with HIV...
...Other regions that had started from much...
...Levels generally showed increases in prevalence...
...rates, mostly within high-risk populations.



Chapter 10 Elasticity and Oscillations

Example 10.8
A Vibrating Loudspeaker Cone

The slope of $x(t)$ is initially zero and then goes negative. Therefore, $v_x(t)$ is a negative sine function:

$$v_x(t) = -v_m \sin \omega t$$

where $\omega = 2\pi f = 160 \text{ rad/s}$ and $v_m = \omega A = 160 \text{ rad/s} \times 0.015 \text{ m} = 2.4 \text{ m/s}$

Discussion As a check, the velocity should be $\frac{1}{2}$ of a cycle ahead of the position. If we imagine shifting the vertical axis to the right (ahead) by 0.01 s , the graph would have the shape of a negative sine function.

Practice Problem 10.8 Acceleration of the Speaker Cone
Sketch a graph and write an equation for $a_x(t)$.

Solution (a) The amplitude is the maximum displacement shown on the graph: $A = 0.015 \text{ m}$.
(b) The period is the time for one complete cycle. From the graph: $T = 0.040 \text{ s}$.
(c) The frequency is the inverse of the period.
$$f = \frac{1}{T} = \frac{1}{0.040 \text{ s}} = 25 \text{ Hz}$$

(d) Since $x = A \cos \omega t$, we write $x(t)$ as a cosine function: $x(t) = A \cos \omega t$ where $A = 0.015 \text{ m}$ and $\omega = 2\pi f = 160 \text{ rad/s}$

10.8 THE PENDULUM
Simple Pendulum

When a pendulum swings back and forth, a string or thin rod constrains the bob to move along a circular arc. However, for oscillations with small amplitude, we assume that the bob moves back and forth along the x-axis; the vertical motion of the bob is negligible. Since the weight of the bob has no x-component, the restoring force is the x-component of the force due to the string. We expect the restoring force to be proportional to the displacement for small oscillations. From Fig. 10.22,

$$\Sigma F_x = -T \sin \theta = -T \theta$$

where L is the length of the string and $\sin \theta \approx \theta$. The y-component of the acceleration is negligibly small, so

$$\Sigma F_y = T \cos \theta - mg = m a_y = 0$$

Since $\cos \theta \approx 1$ for small θ , $T = mg$. Then

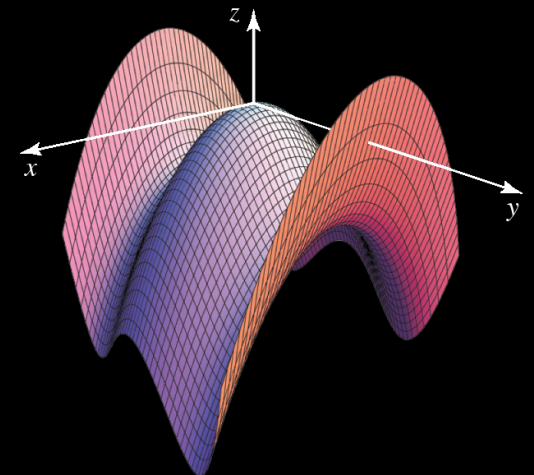
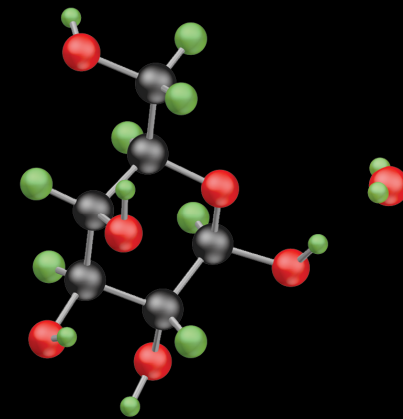
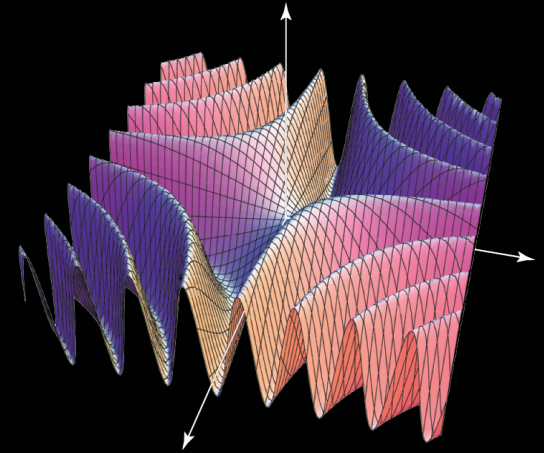
$$\Sigma F_x = -T \theta = -mg \theta = m a_x$$

Solving for a_x :

$$a_x = -\frac{g}{L} x$$


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.

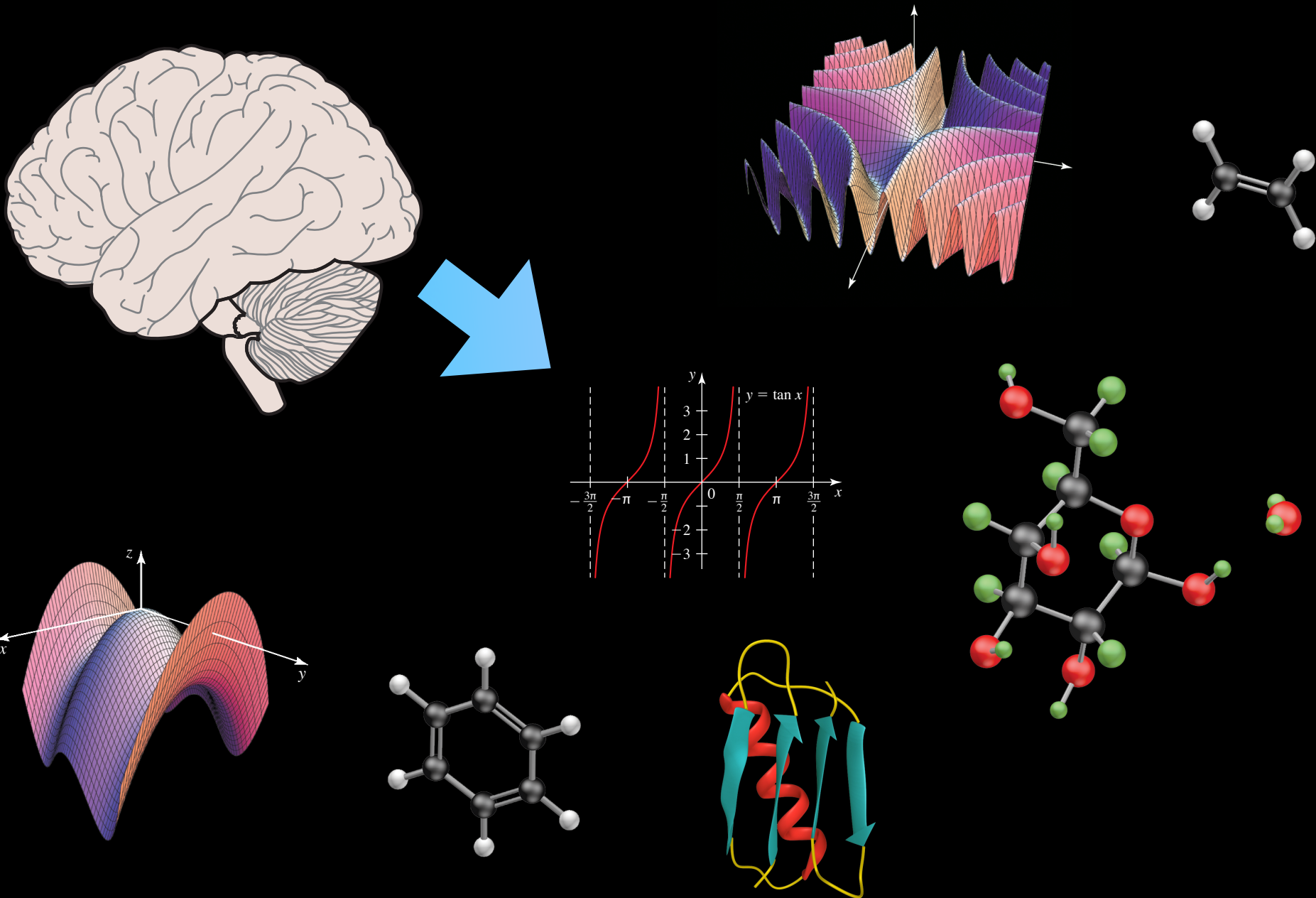
REMEMBER

- Don't assume the artist knows the content.

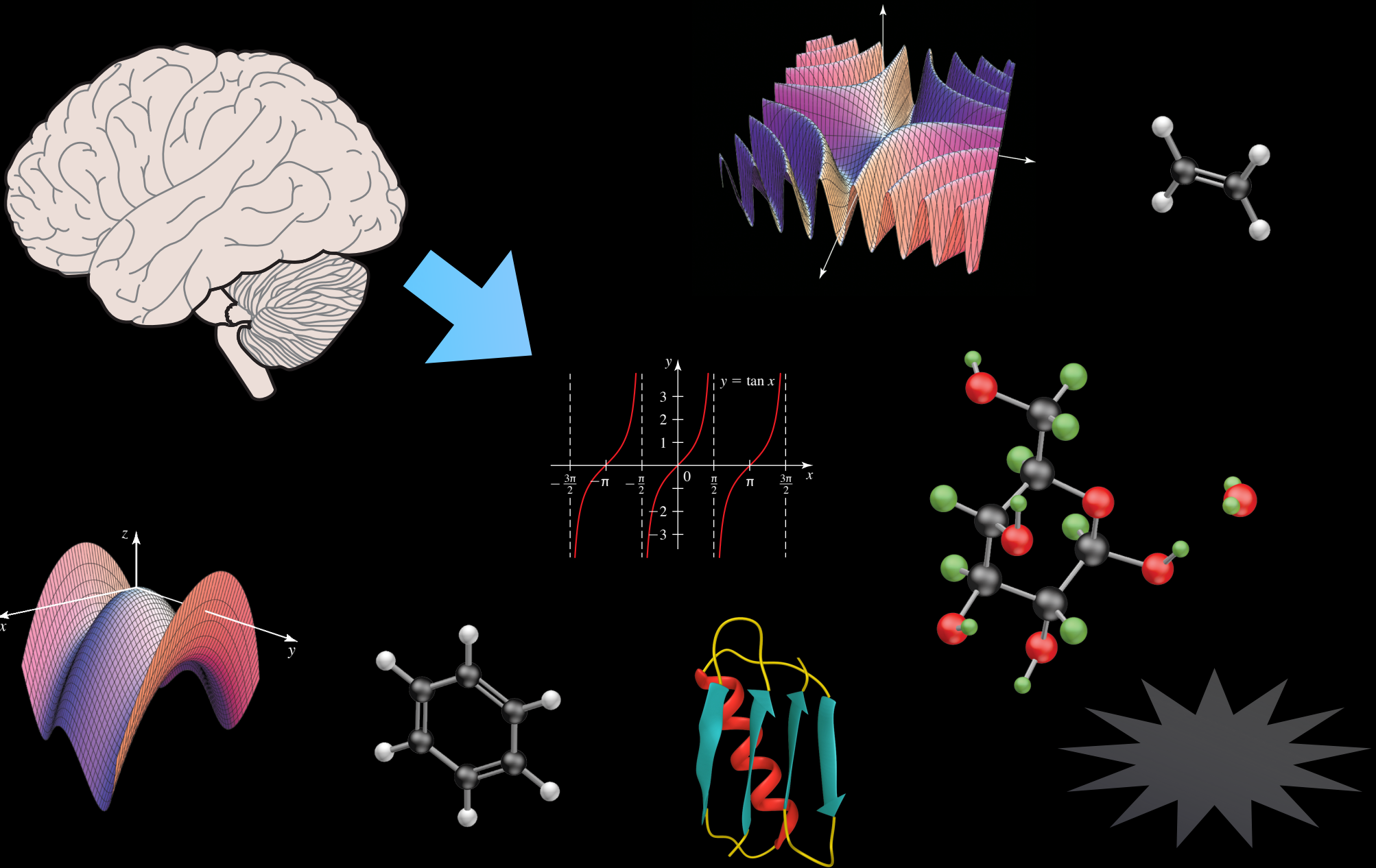
Often, artists will be familiar with the subject being illustrated but information changes quickly.

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

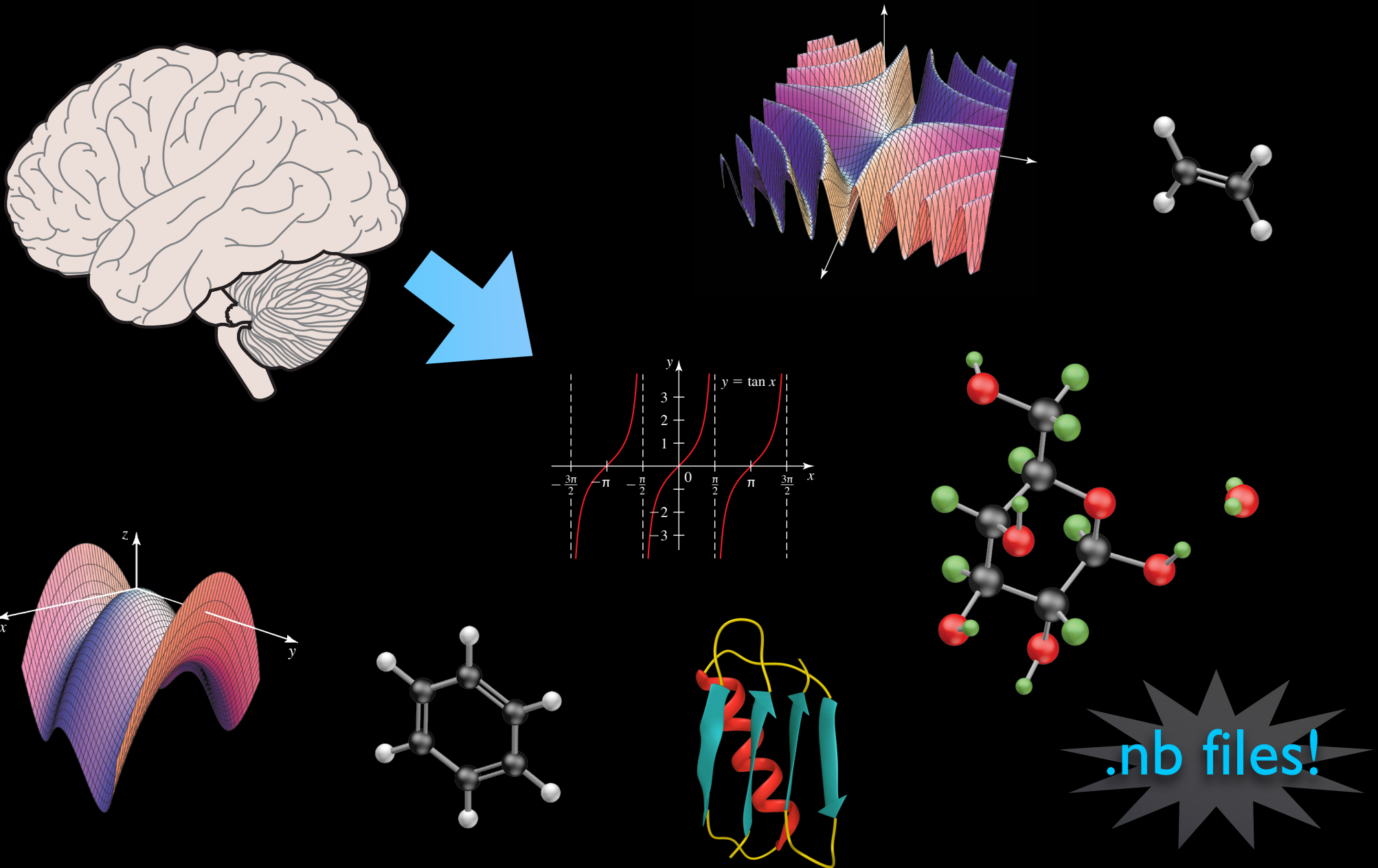
How can we move ideas from the mind of the content creator to the artist with the least amount of translation?



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

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Transfer information in an organized and clear way

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- 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?

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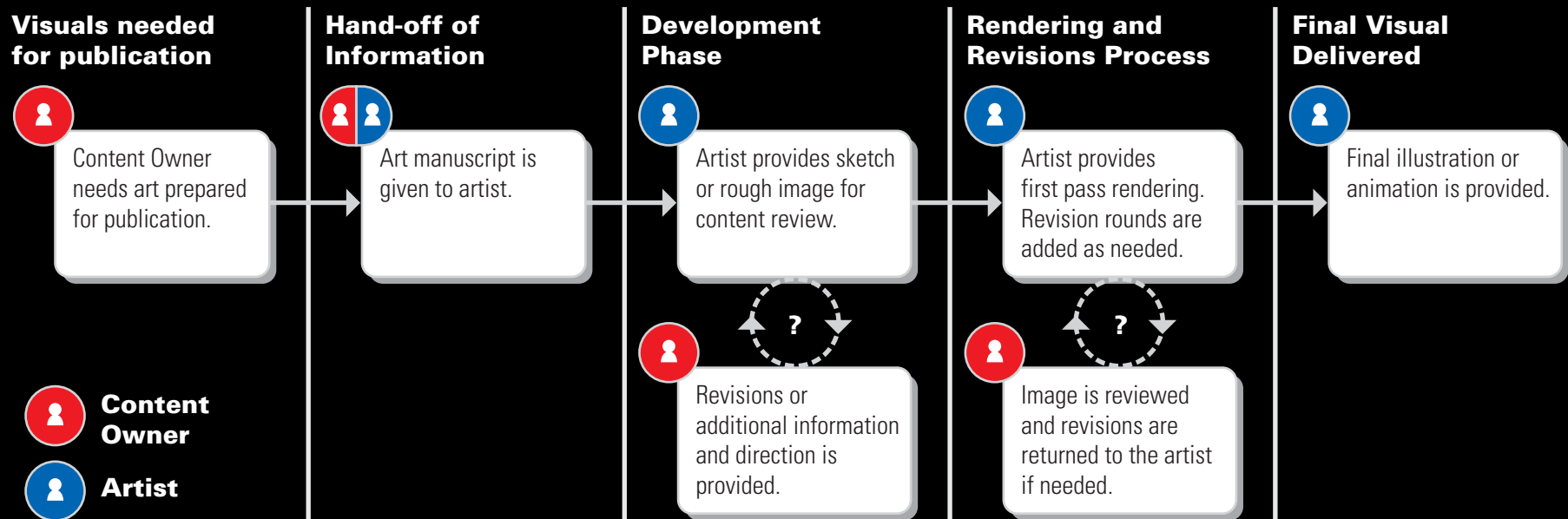
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- Are there supporting images needed - If I'm showing statistics about a specific country, would it be helpful to have a **locator map** to go along with it? Would the information be clearer with **bar charts, pie graphs, etc.?**

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- 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



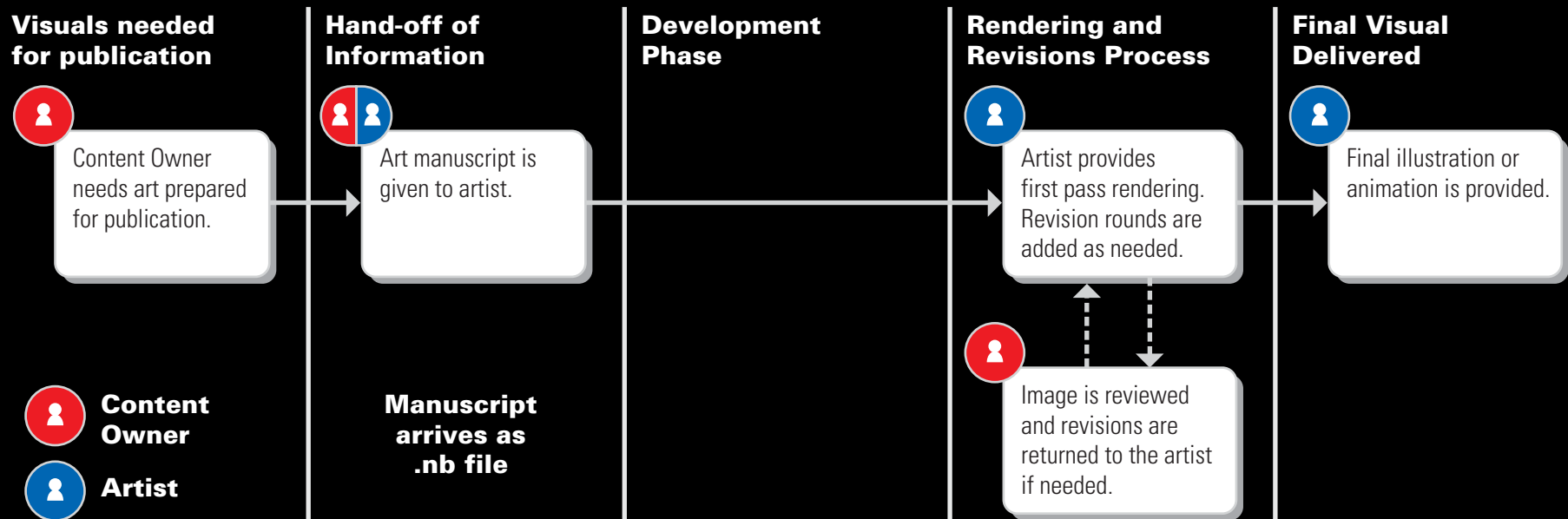
Standard workflow

- 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.

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Standard Pathway from Concept to Creation of Visuals



Workflow using .nb file as manuscript

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Value in information handoff via .nb files

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- Author has **more control** over his or her content.

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- Artist has content that can be **imported directly** into their applications.

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- Artist has content that can be **imported directly** into their applications.
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- **Accuracy** is maintained working with original materials.

The Spectrum of Manuscript

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

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

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The Spectrum of Manuscript

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- **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
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and a larger leap to
final image

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Written
description

Example
from
competitor

Hand-drawn
author
sketches

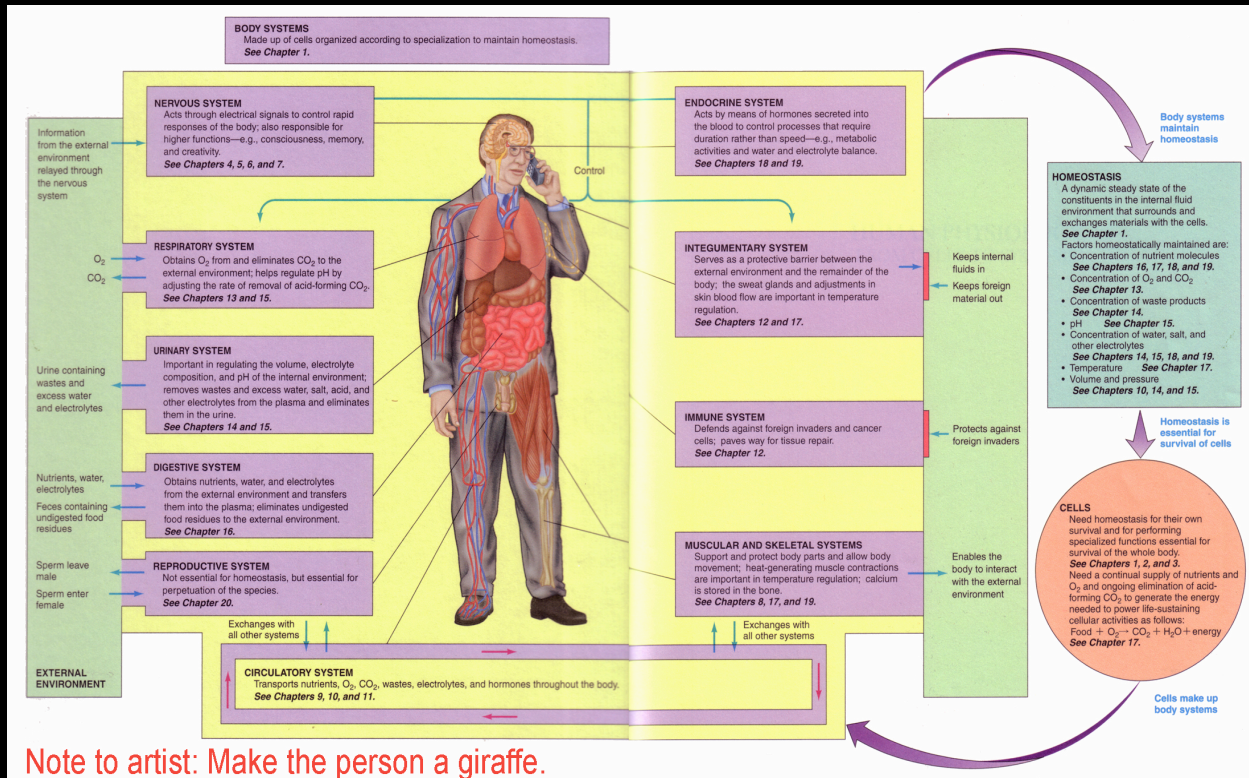
Data to scan
and trace or
input

.nb file as
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.

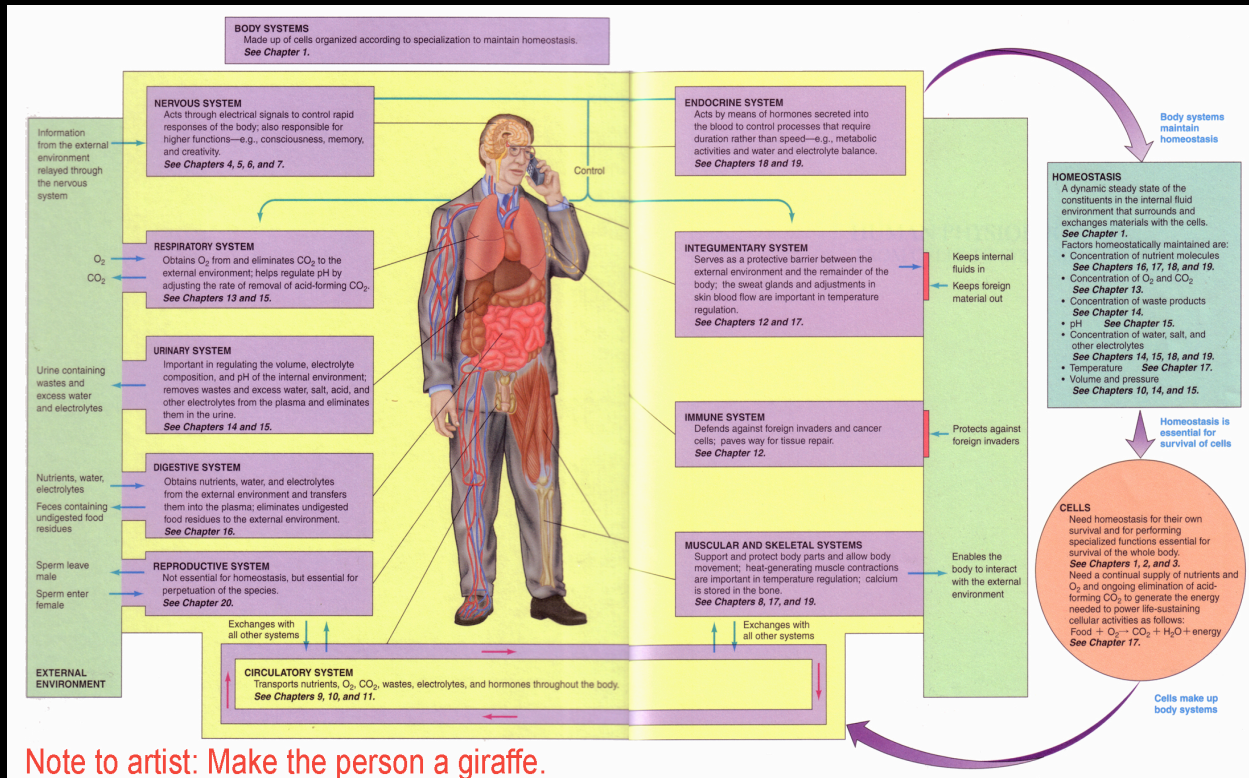
The Spectrum of Manuscript - Bad



Note to artist: Make the person a giraffe.

← Good reference for layout and labeling

The Spectrum of Manuscript - Bad

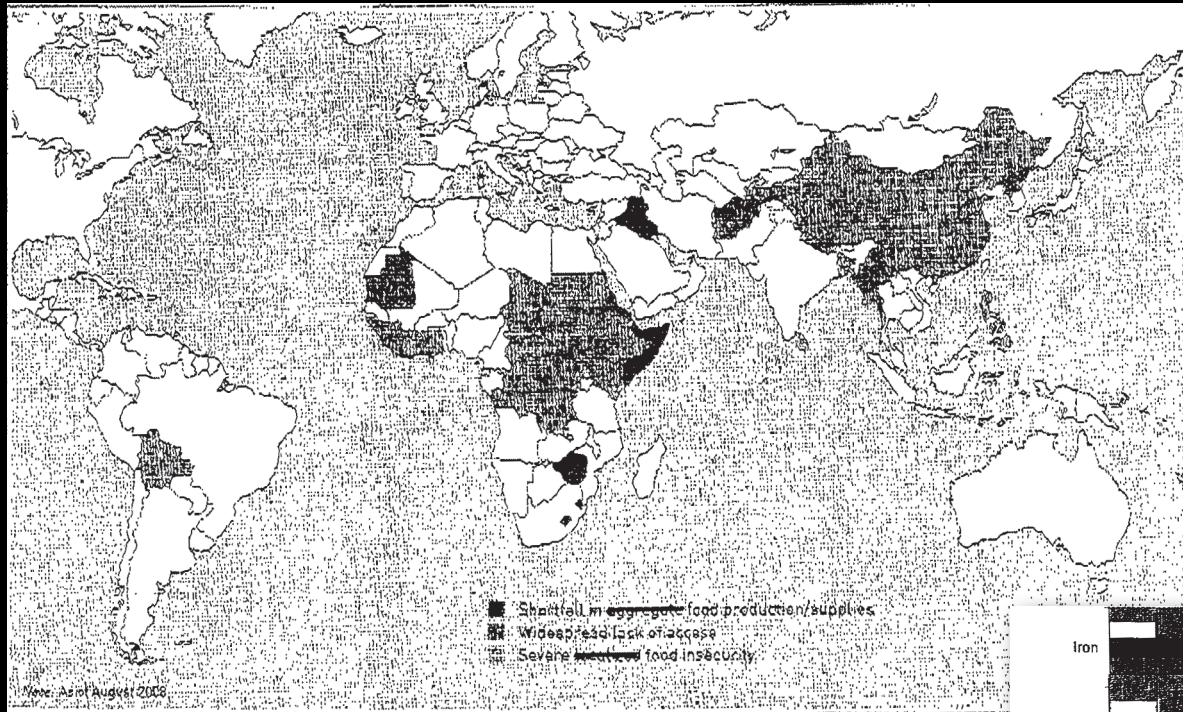


← Good reference for layout and labeling

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

Note to artist: Make the person a giraffe.

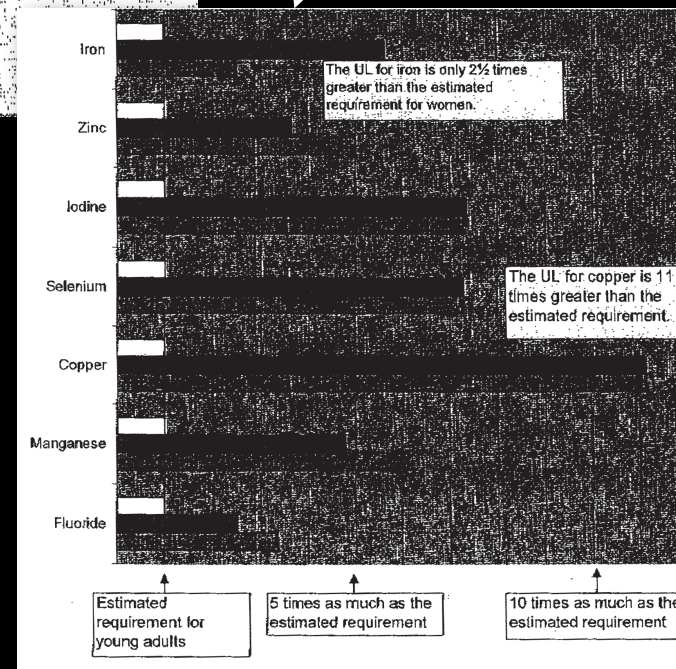
The Spectrum of Manuscript - Bad



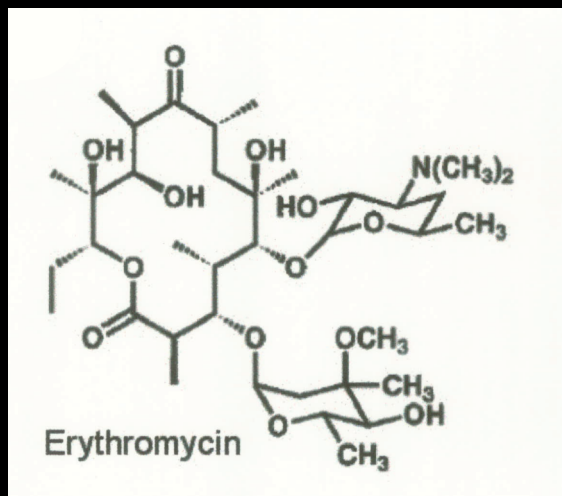
Color map according to key

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

Manuscript pages provided are what the author wants



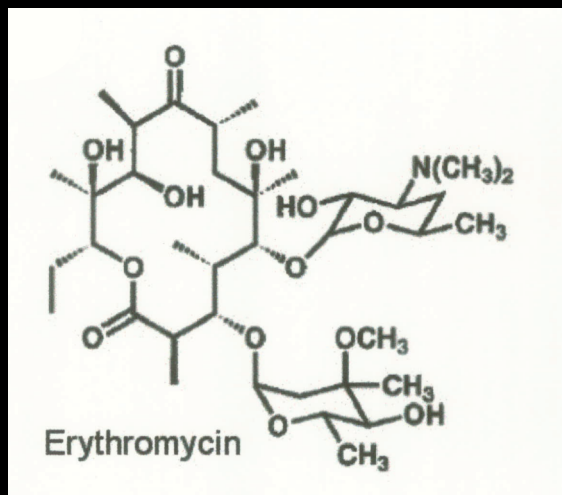
The Spectrum of Manuscript - Bad



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

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

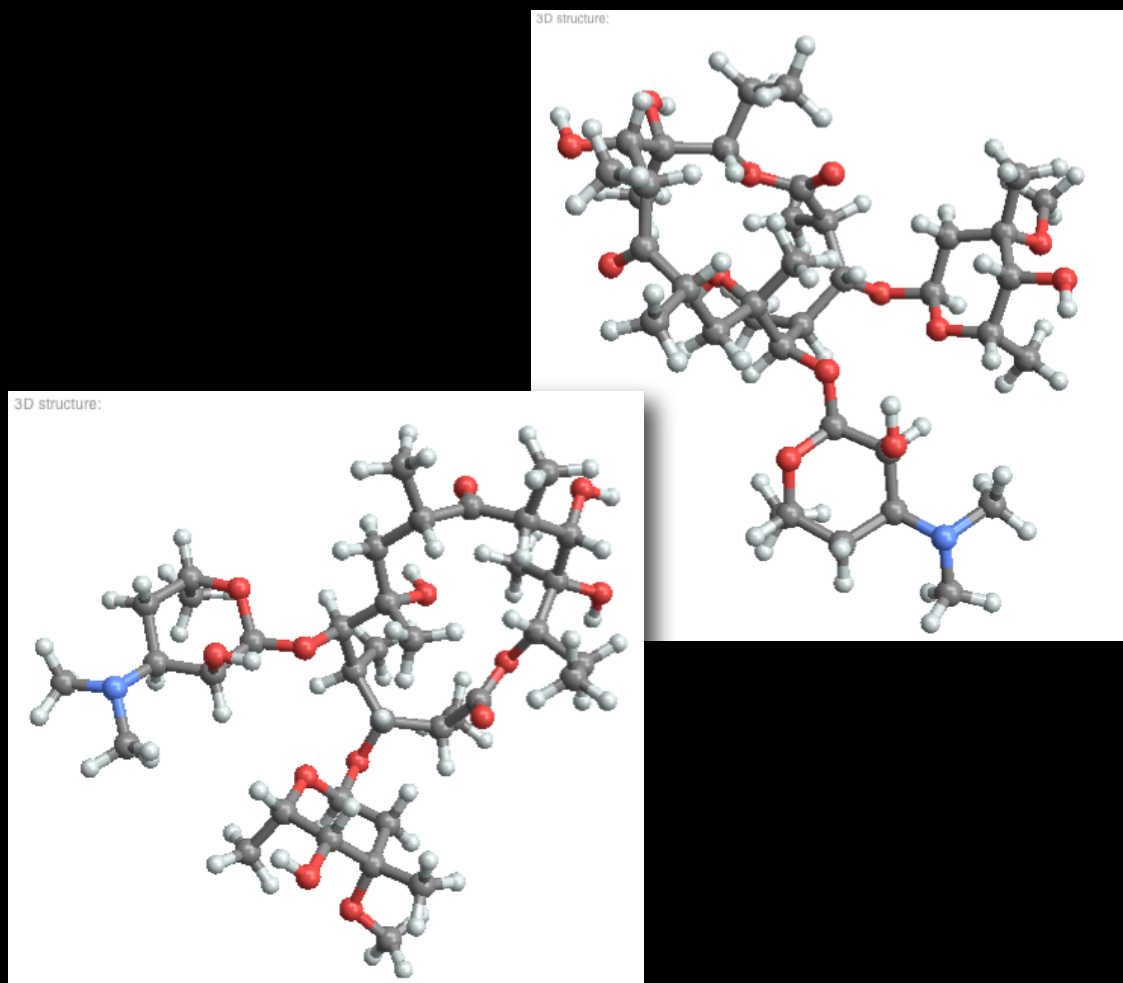
The Spectrum of Manuscript - Bad



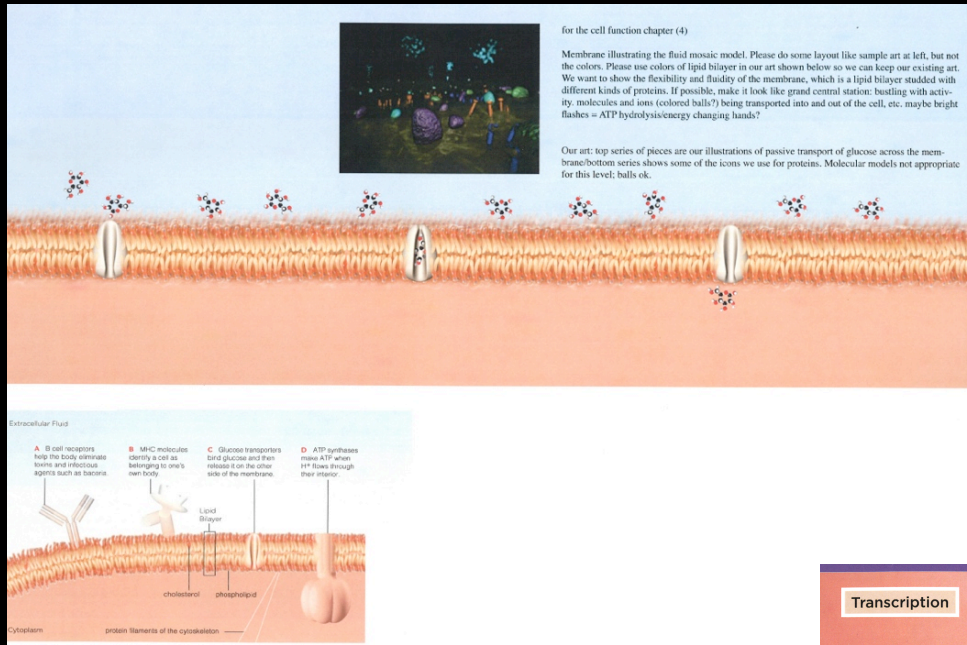
← 2D reference for 3D image.
Artist is responsible for pulling content.

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

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

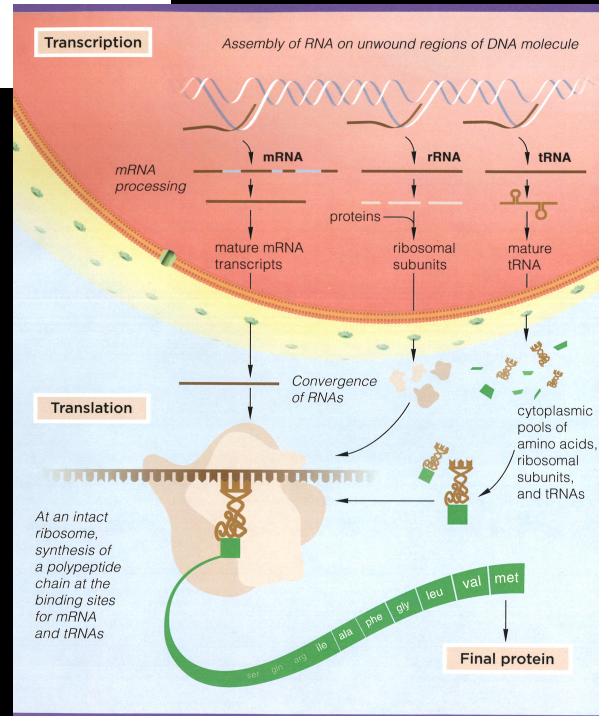


← Artist instructions

References

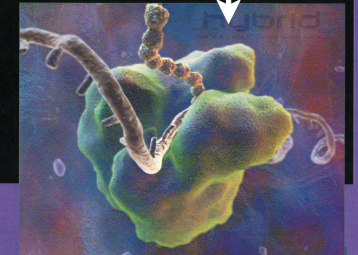
↑ Content and callouts →

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

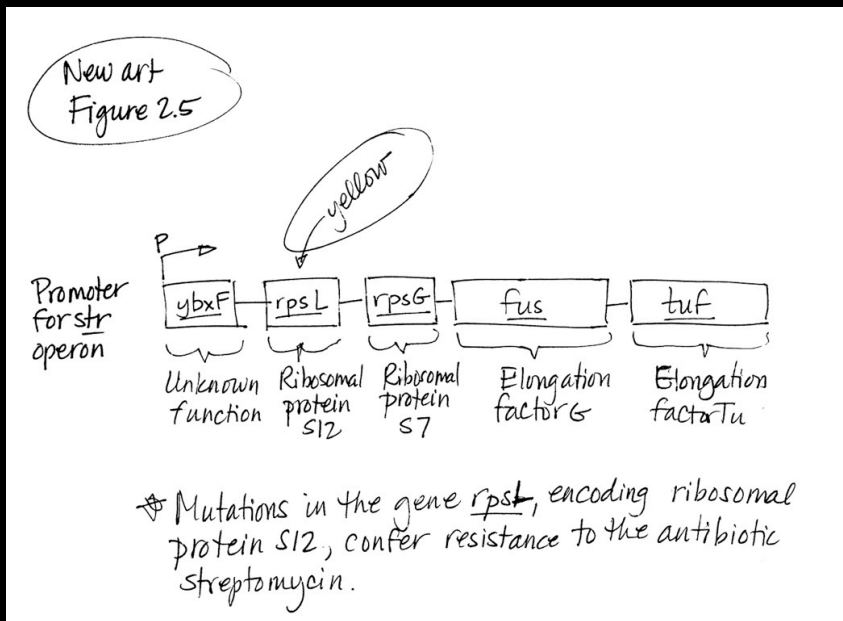


for the gene expression chapter, we'd like a dimensional piece that uses the conceptual components of figure 13.12 in C7, p.206 (on the left). The parts of this figure that we want to show are 1) DNA in the nucleus being transcribed into RNA, 2) RNA coming out of the nuclear pores, 3) different RNAs converging in the cytoplasm, and 4) the result of the convergence, which is the polypeptide coming out of the ribosome (more than one ribosome translating the same mRNA if possible).

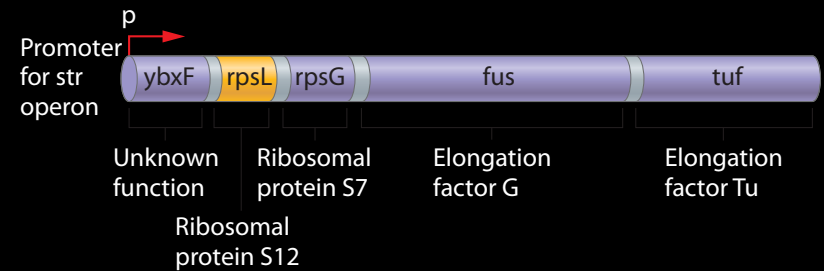
The art below shows dimensionality and the level of detail we like. The bottom art shows a nucleus with DNA in it, but the DNA does not come out of the nucleus as the drawing implies. Any color that works is fine, although transparency and light as in the immunity piece would be fabulous (the art below shows a ribosome that looks a little like a pool attached to mRNA and protein that look like dead twigs). However you can get the layout to work is fine, but please remember not to put important parts in the gutter. No labels or callouts.



The Spectrum of Manuscript - Good



Hand drawn author sketches



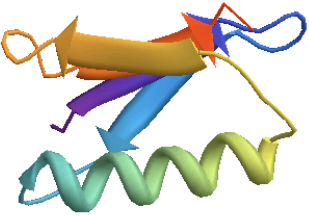
Mutations in the gene *rpsL*, encoding ribosomal protein S12, confer resistance to the antibiotic streptomycin.

Final art drawn from manuscript

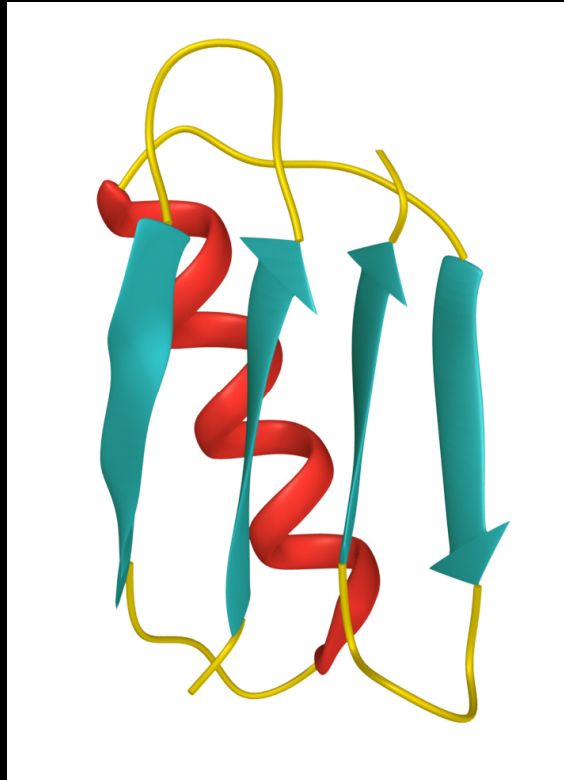
The Spectrum of Manuscript - Now we're talking!!

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

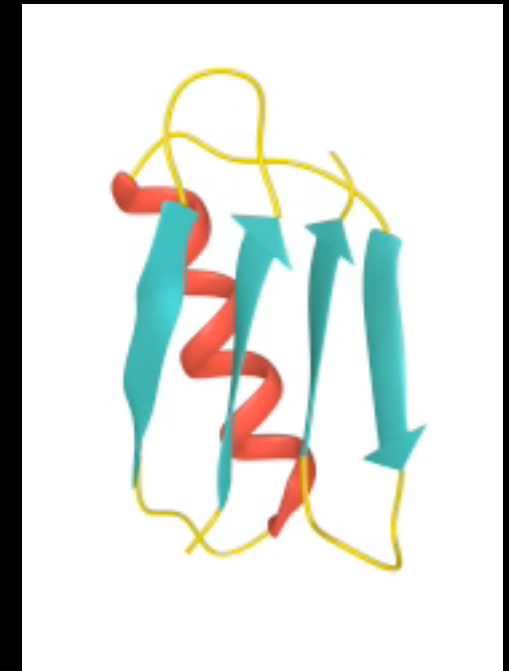
```
ribbonG = Import["/Users/jgriffin/Desktop/PG_work/2NMQ.pdb"]
ballnstickG = Import["/Users/jgriffin/Desktop/PG_work/2NMQ.pdb",
  "Rendering" -> "BallAndStick"]
spacefillG = Import["/Users/jgriffin/Desktop/PG_work/2NMQ.pdb",
  "Rendering" -> "Spacefilling"]
wireframeG =
ballnstickG /. {Sphere[x_, y_]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



.nb file as manuscript



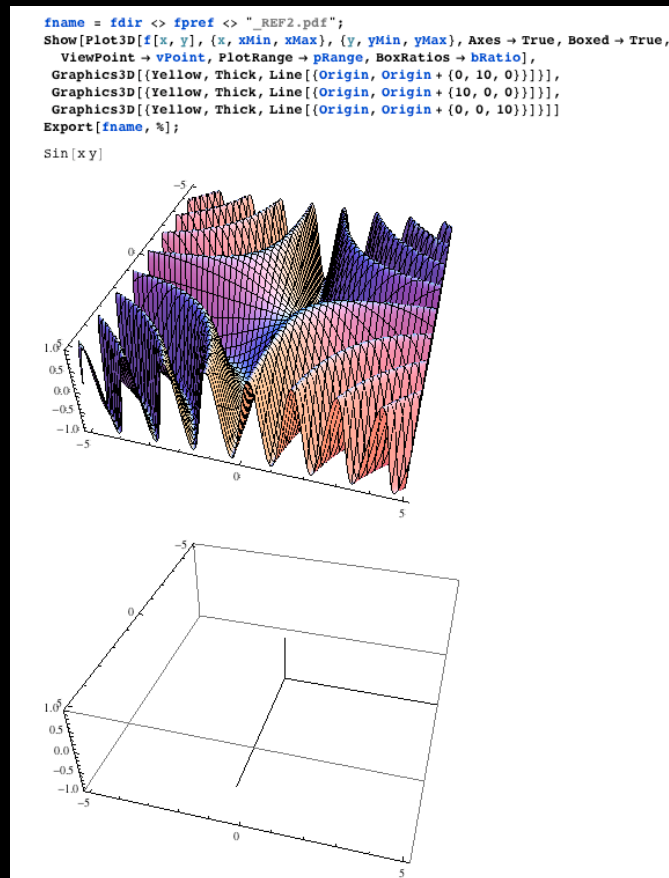
Final printed file



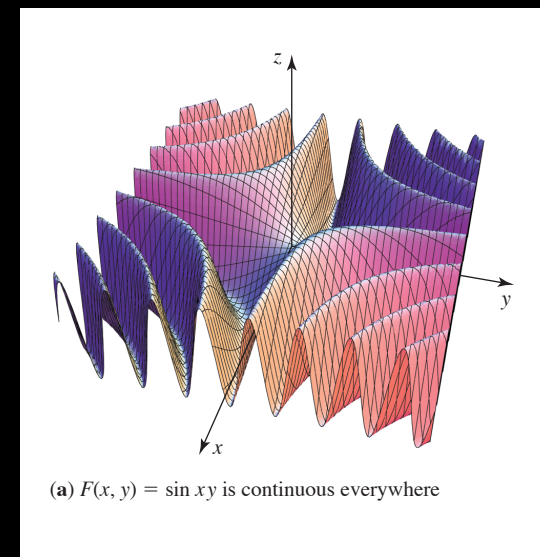
Final animation

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

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



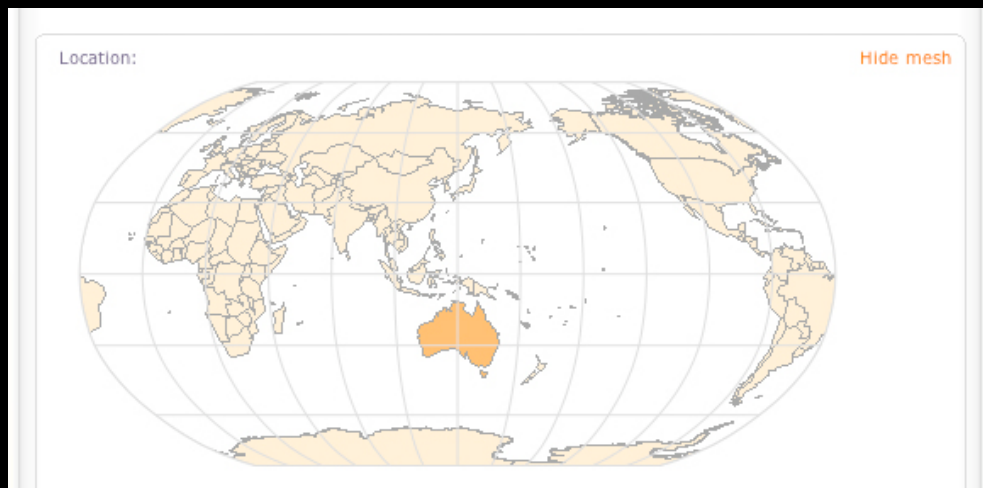
.nb file as manuscript



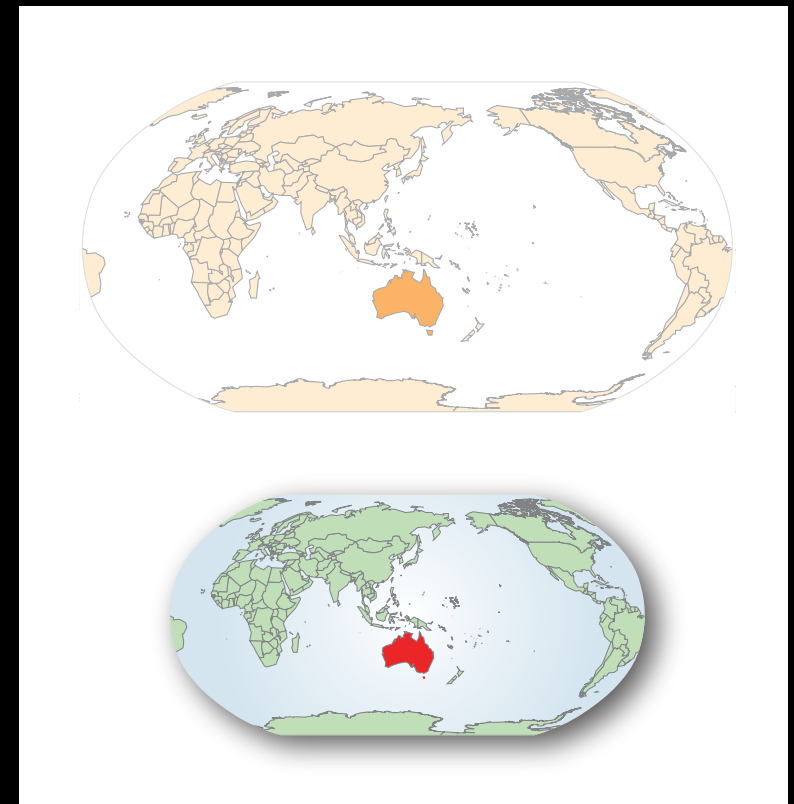
Final printed file

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

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



.nb file as manuscript



Illustrator final file

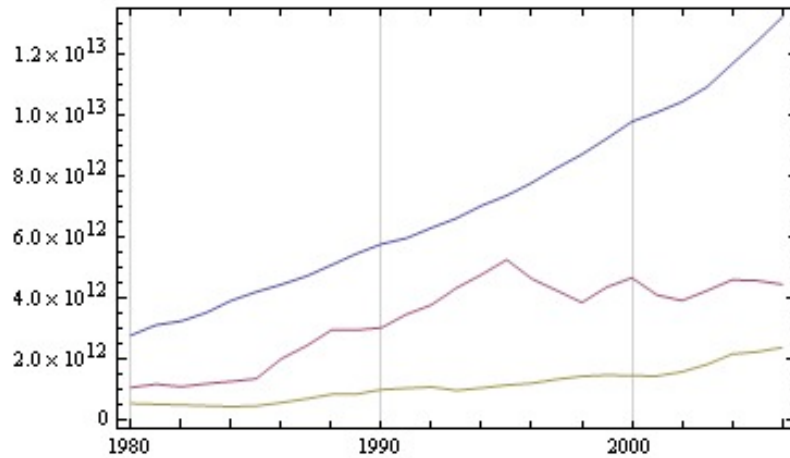
Top: original .eps from .nb file
Bottom: Book styles/sizing applied

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

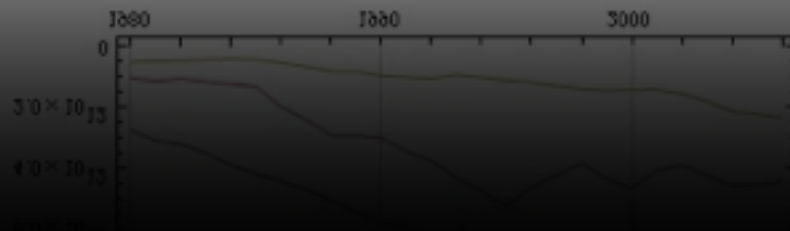
Case Study One - Using *Mathematica* for 2D content

```
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)"]
```

GDP US(Blue) vs Japan(Purple) vs UK(Tan)



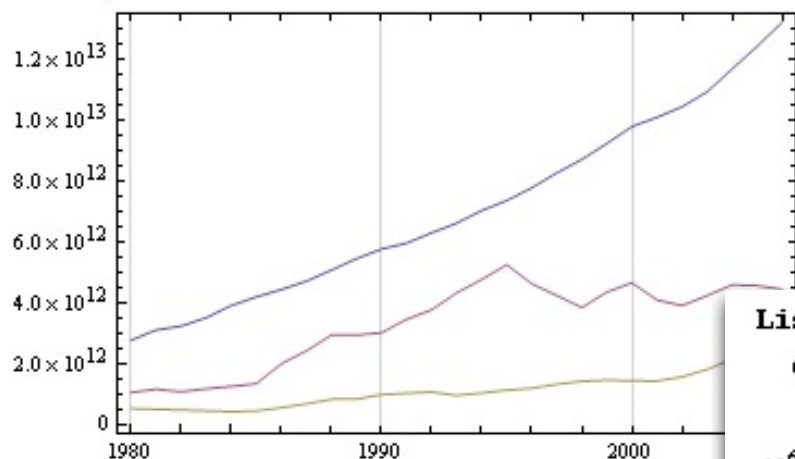
.nb file showing line graph
and scatter plot data for two
illustrations



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

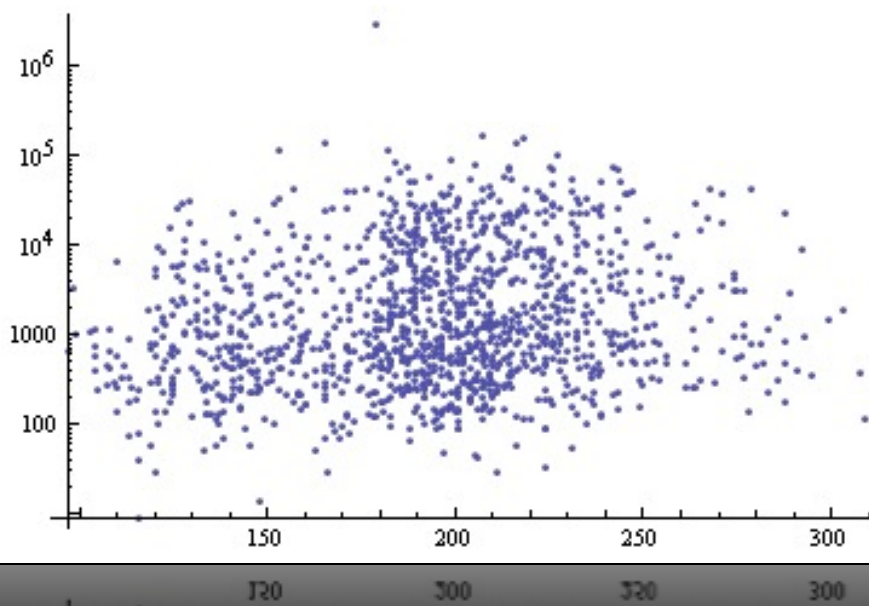
```
data1 = CountryData["UnitedStates", {"GDP"}, {1980, 2008}];  
data2 = CountryData["Japan", {"GDP"}, {1980, 2008}];  
data3 = CountryData["UnitedKingdom", {"GDP"}, {1980, 2008}];  
DateListPlot[{data1, data2, data3}, Joined -> True,  
PlotLabel -> "GDP US(Blue) vs Japan(Purple) vs UK(Tan)"]
```

GDP US(Blue) vs Japan(Purple) vs UK(Tan)

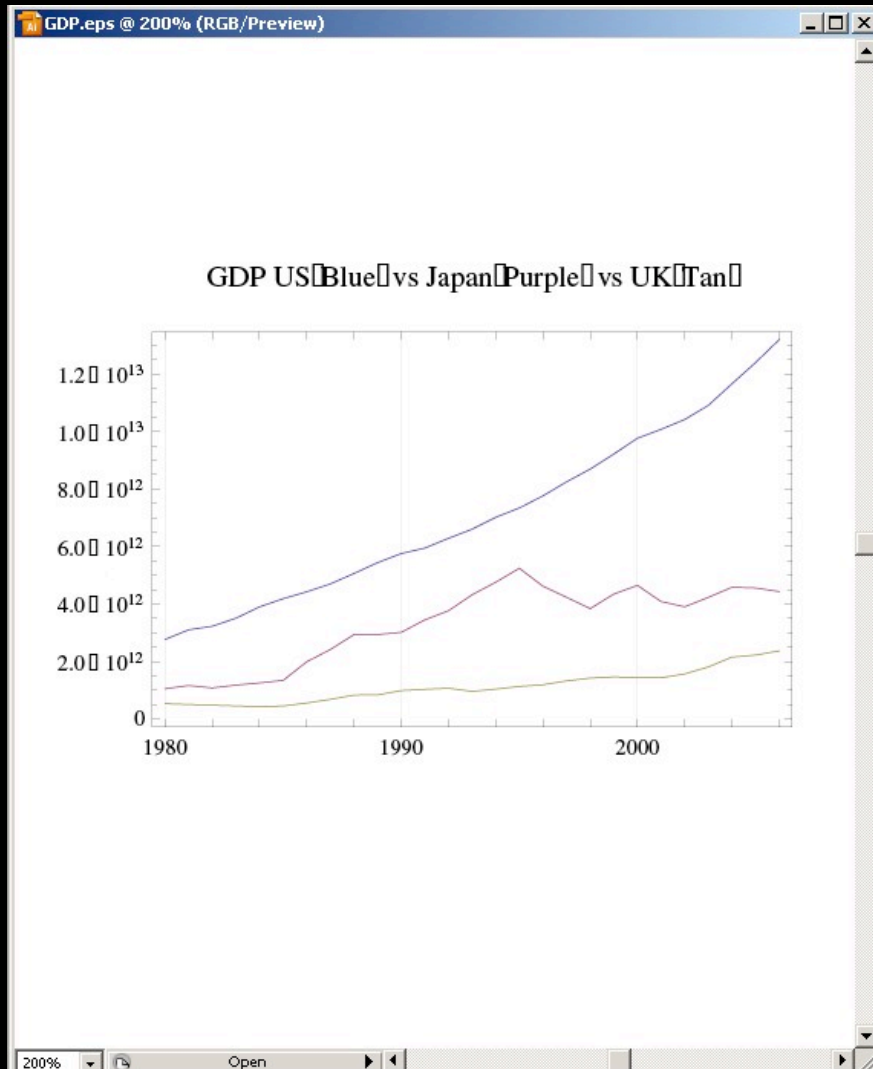


.nb file showing line graph
and scatter plot data for two
illustrations

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



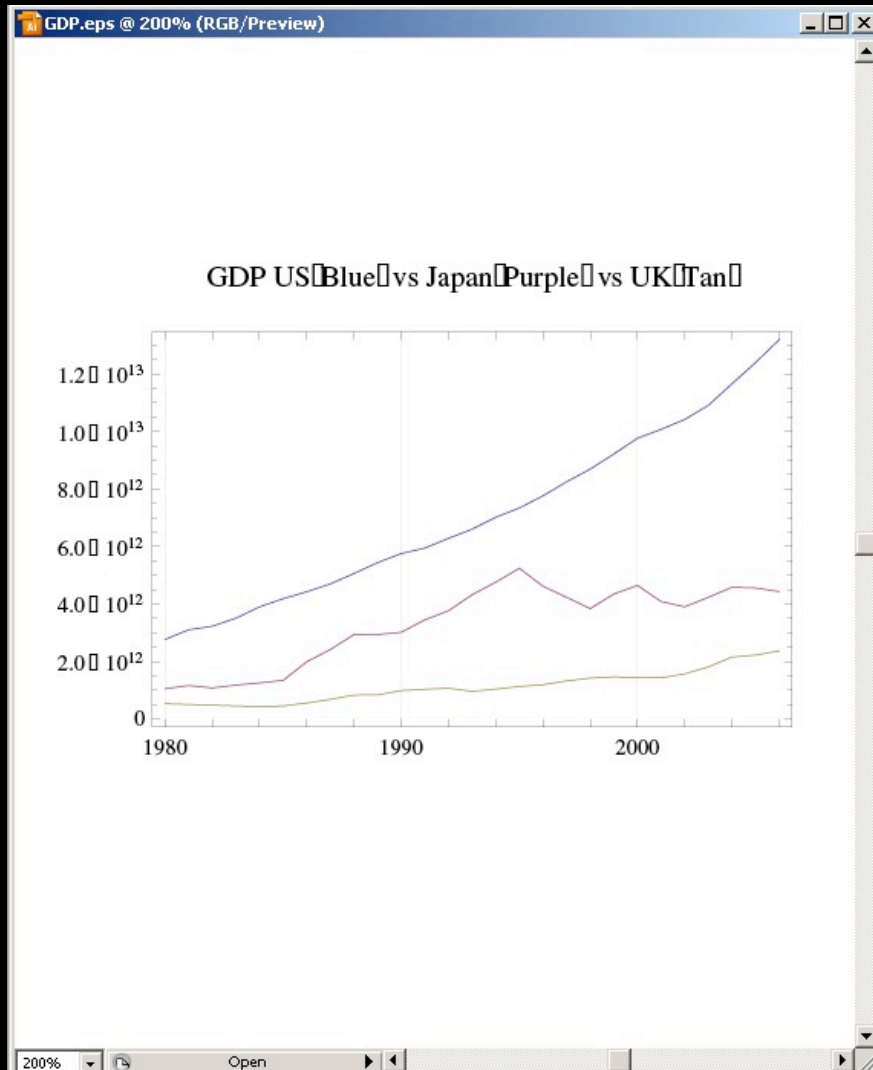
Case Study One - Using *Mathematica* for 2D content



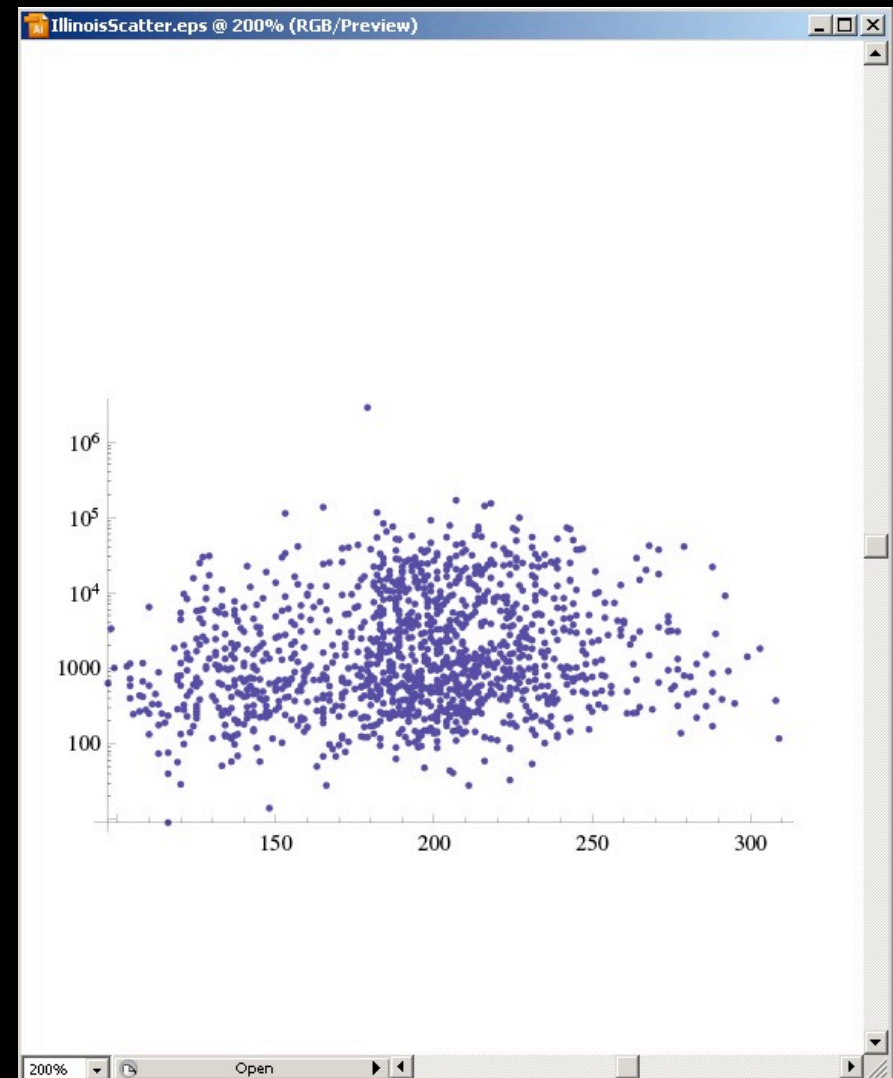
.nb data exported as .eps directly into Illustrator.

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.

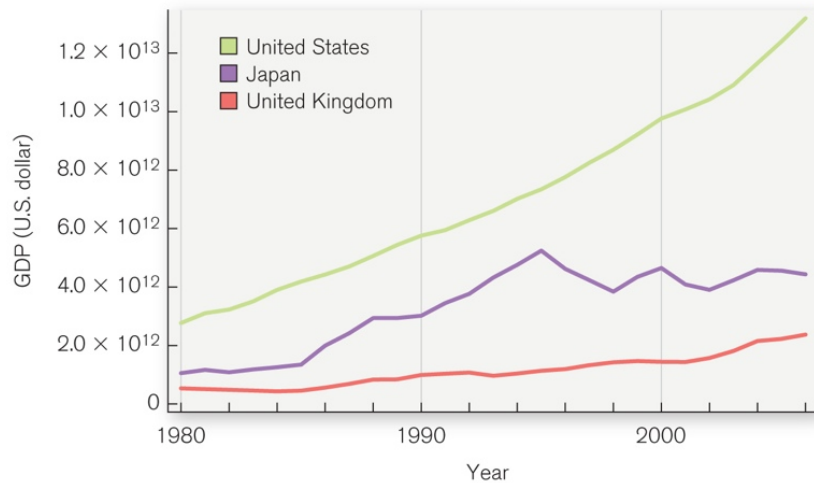


Content of the file is easy to
manipulate and adjust to
book styling

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



GDP of U.S. vs. Japan vs. U.K.



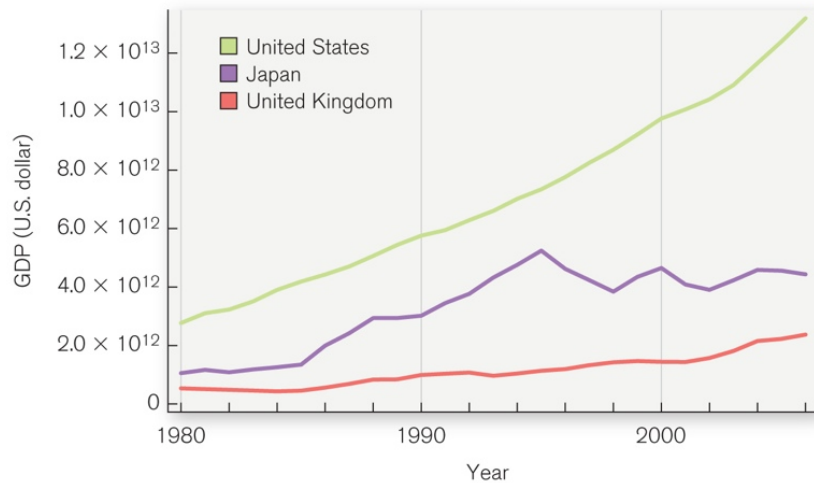
Final images as seen in print

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

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

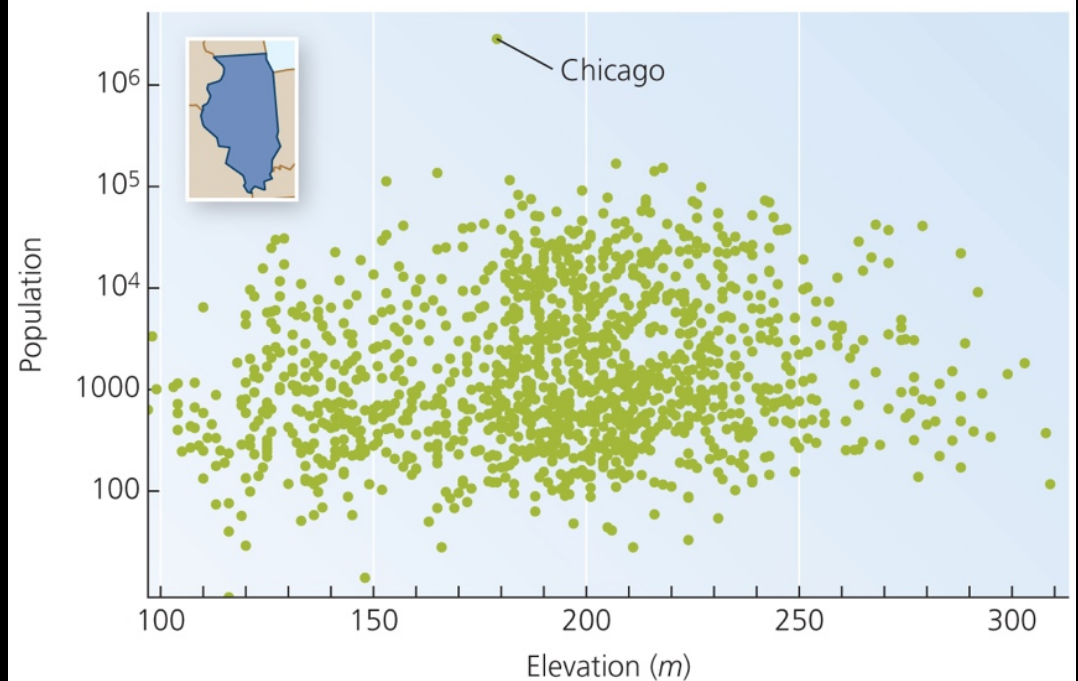


GDP of U.S. vs. Japan vs. U.K.



Final images as seen in print

Illinois population distribution by elevation

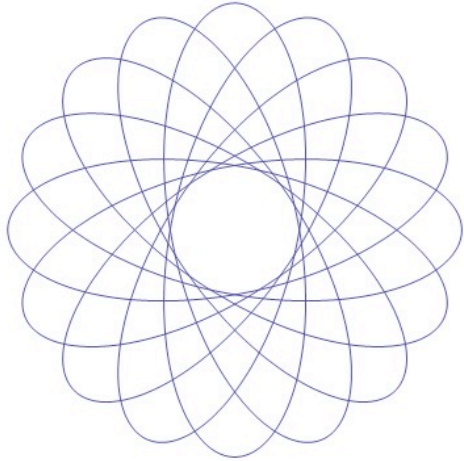


Accuracy was maintained
and time was saved not
having to redraw data!

Case Study Two - *Mathematica* to define motion path

Spirograph

```
ParametricPlot[{{ $\frac{9 \cos[t]}{16} + \cos\left[\frac{9t}{7}\right]$ ,  $\frac{9 \sin[t]}{16} - \sin\left[\frac{9t}{7}\right]$ }, {t, 0, 14 \pi}},  
Axes -> False]
```

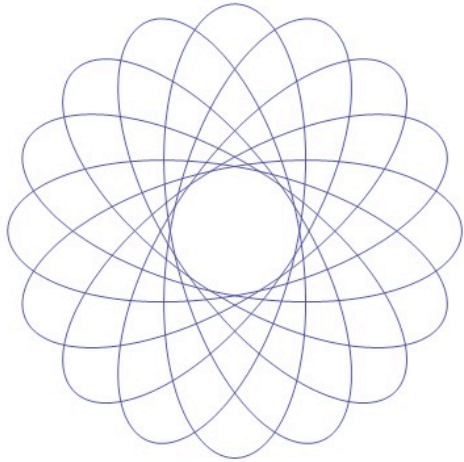


.nb file showing equation and path for pendulum motion.

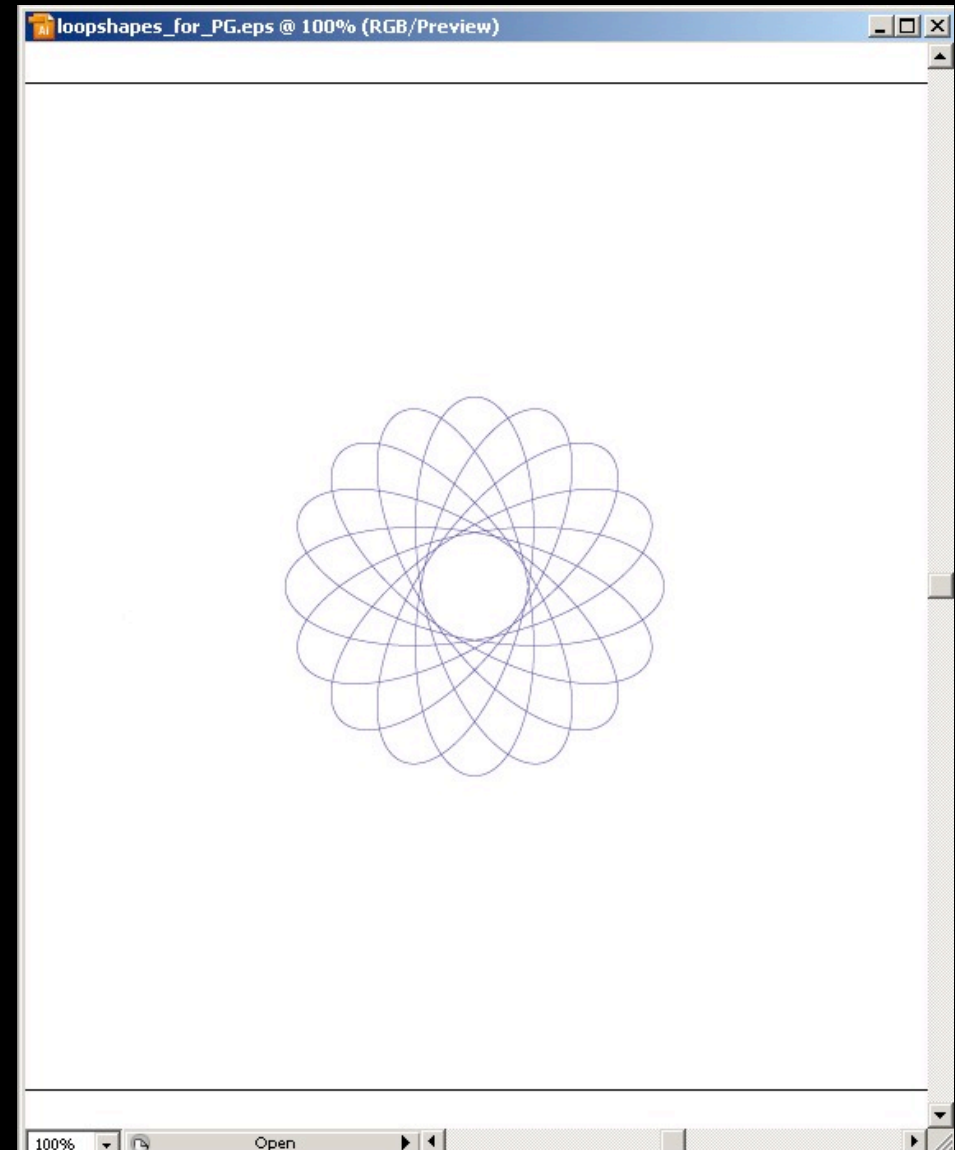
Case Study Two - *Mathematica* to define motion path

Spirograph

```
ParametricPlot[{{ $\frac{9 \cos[t]}{16} + \cos\left[\frac{9t}{7}\right]$ ,  $\frac{9 \sin[t]}{16} - \sin\left[\frac{9t}{7}\right]$ }, {t, 0, 14 \pi}},  
Axes -> False]
```



.nb file showing equation and path for pendulum motion.

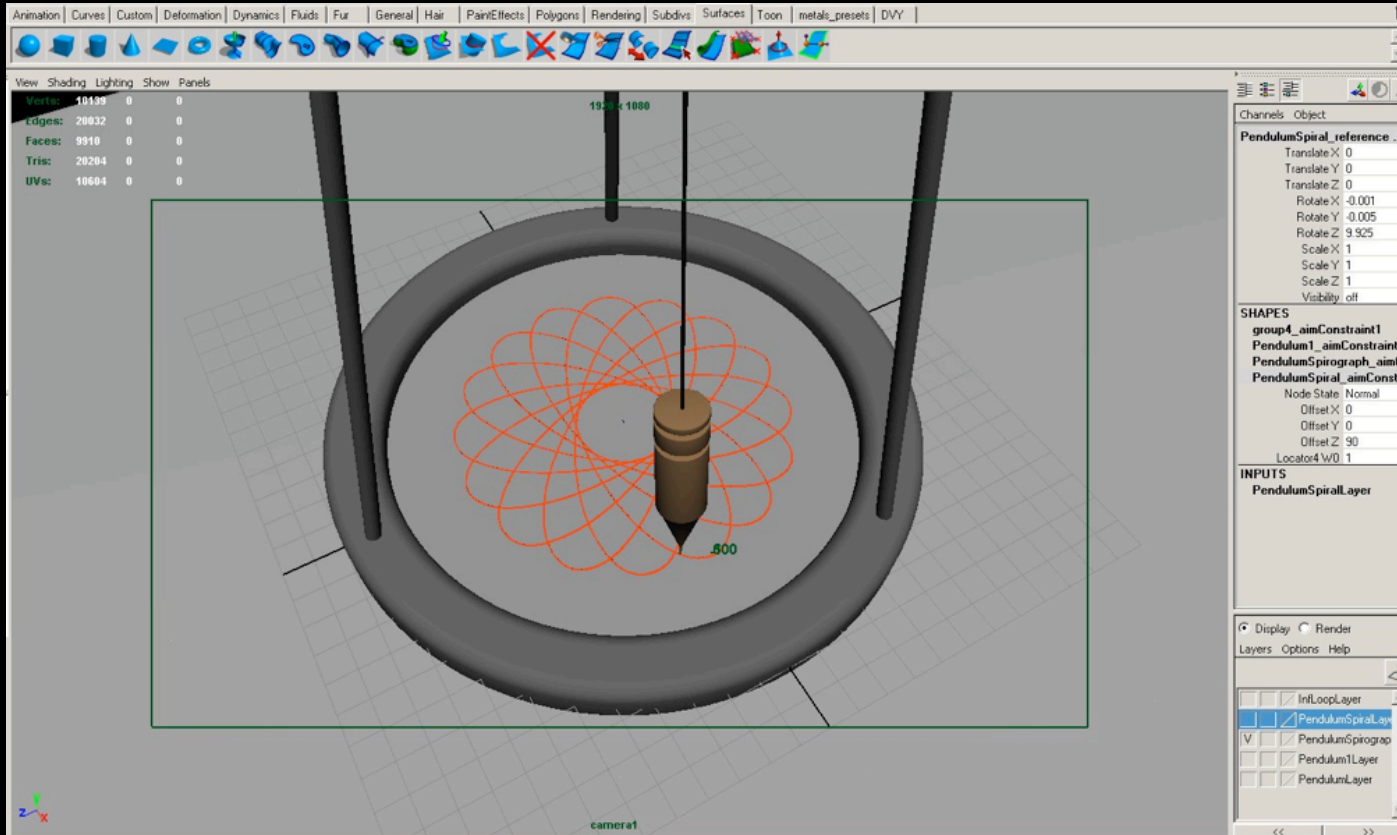


.nb file is imported into Illustrator to be used by Maya as the motion pathway for the final animation.

Case Study Two - Using *Mathematica* to dictate motion

Maya view showing motion plot from *Mathematica*

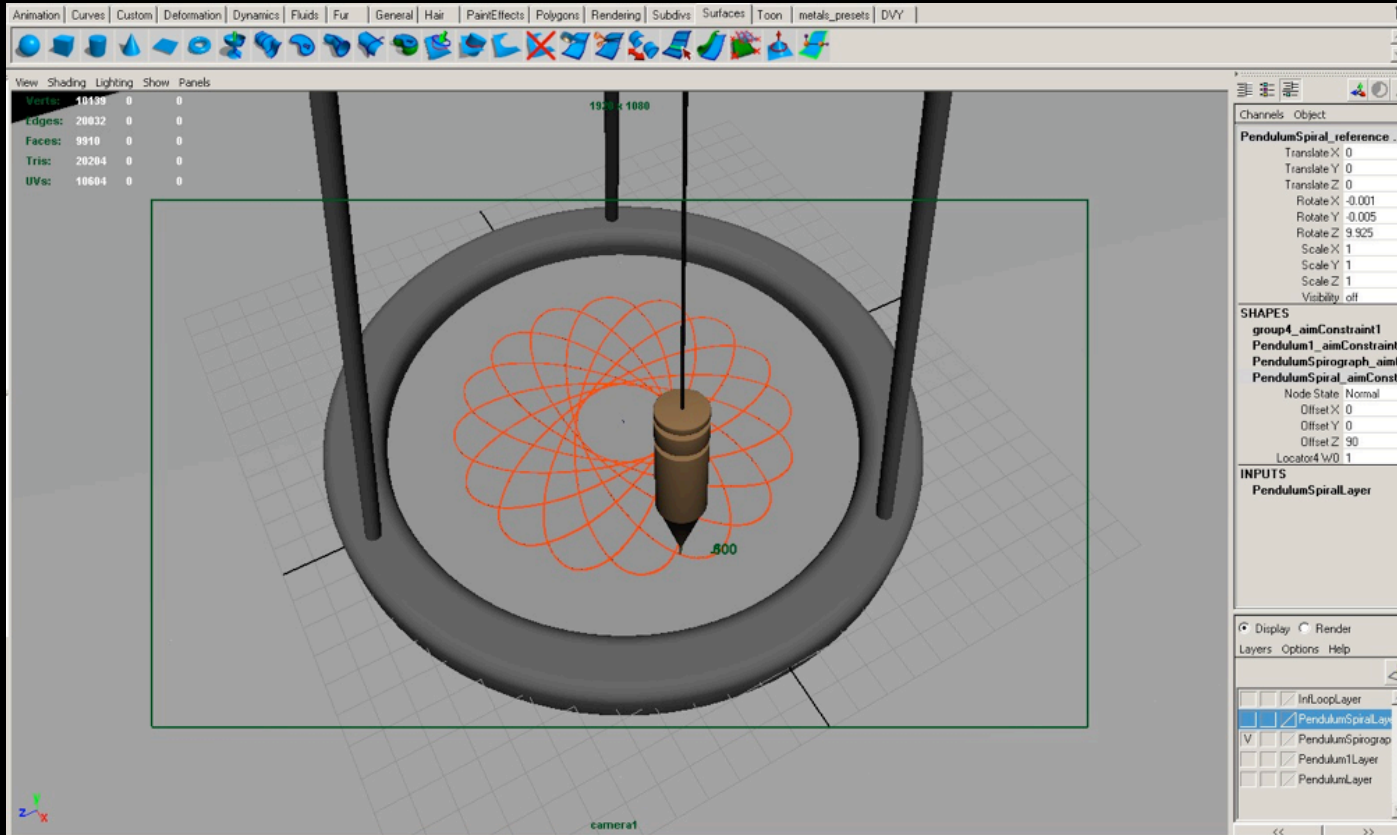
Mathematica provided Maya with an equation based pathway for it to trace.



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.

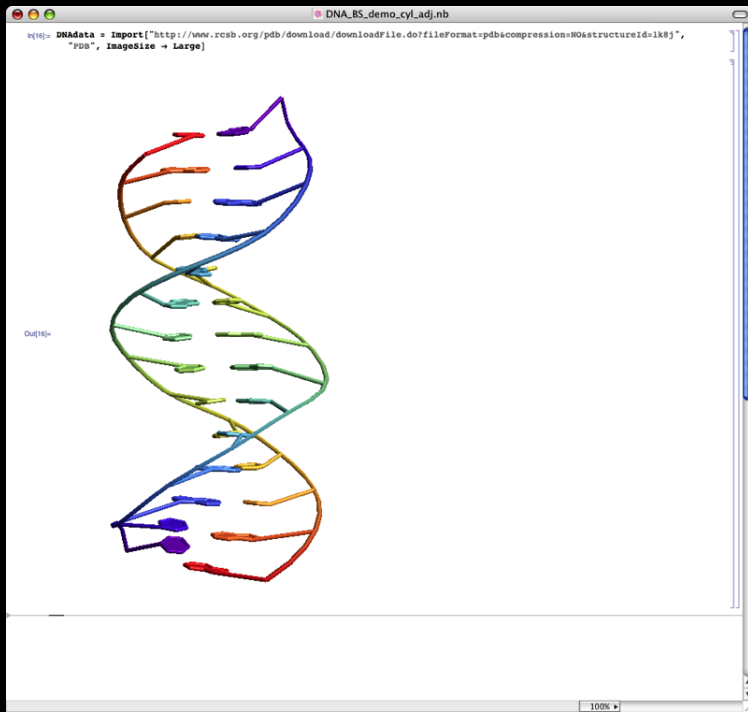
Case Study Two - Using *Mathematica* to dictate motion

$$f_x(t) = \frac{9 \cos(t)}{16} + \cos\left(\frac{9t}{7}\right)$$

$$f_y(t) = \frac{9 \sin(t)}{16} - \sin\left(\frac{9t}{7}\right)$$

Final animation in Maya

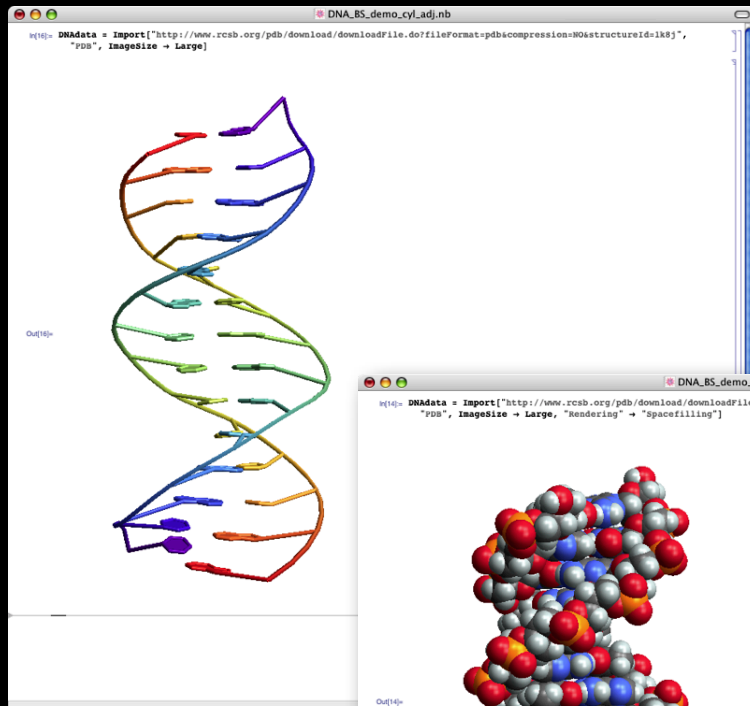
Case Study Three - Using *Mathematica* for 3D Content



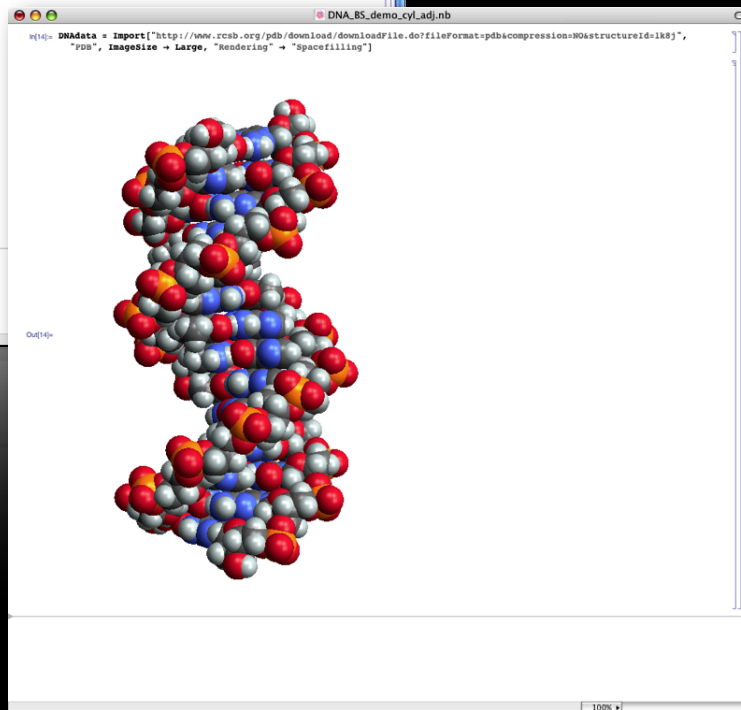
Structure information of DNA can be **imported directly** from the online protein databank in *Mathematica*.

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*.

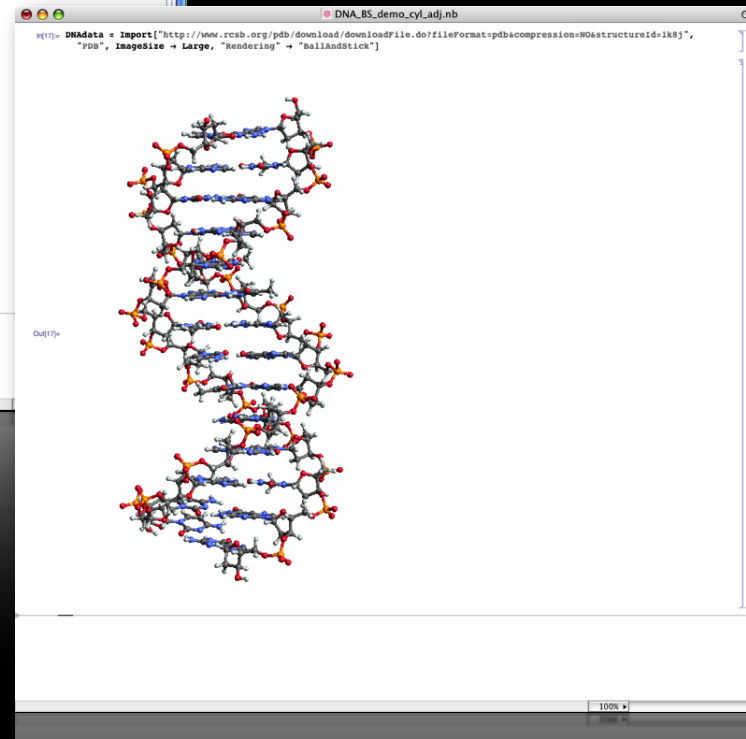
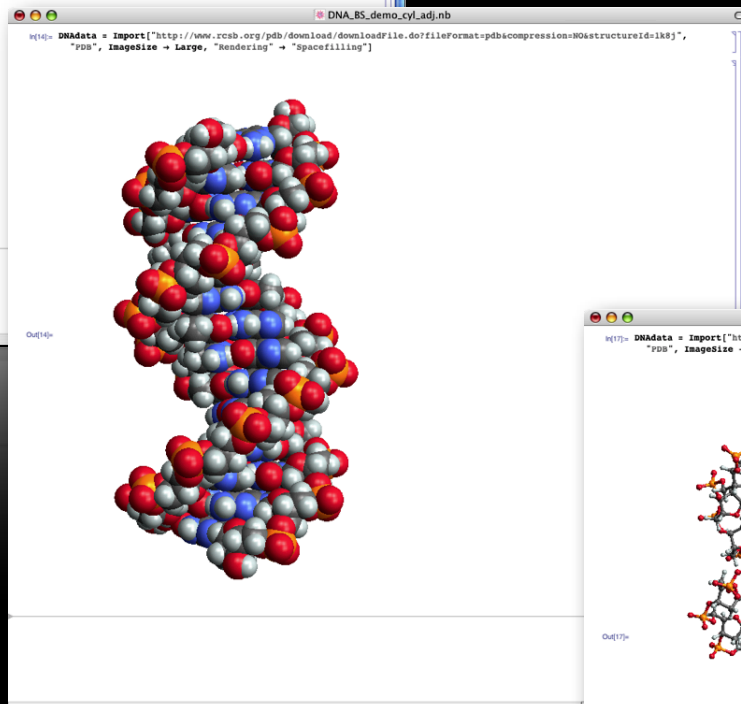
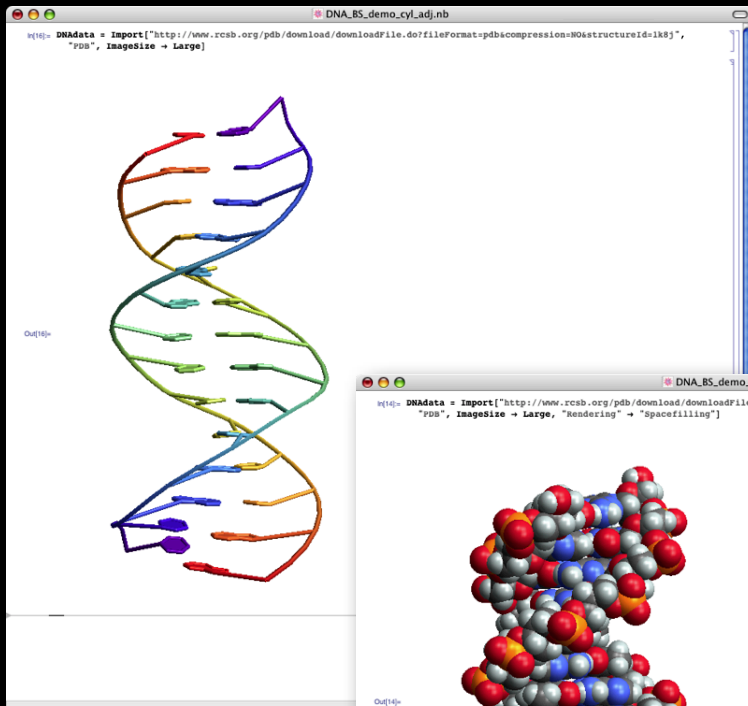


The default is a ribbon-like structure. By changing the **“Rendering”** option, spacefilling and ball and stick models are available.

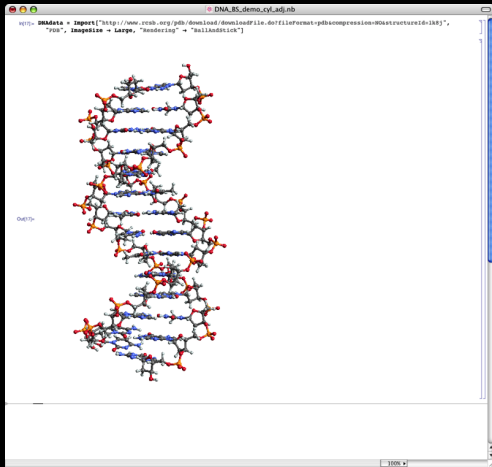
Case Study Three - Using *Mathematica* for 3D Content

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.

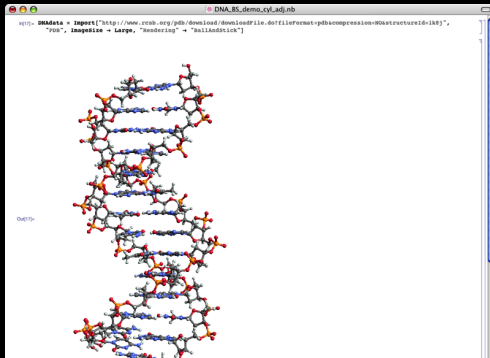


Case Study Three - Using *Mathematica* for 3D Content

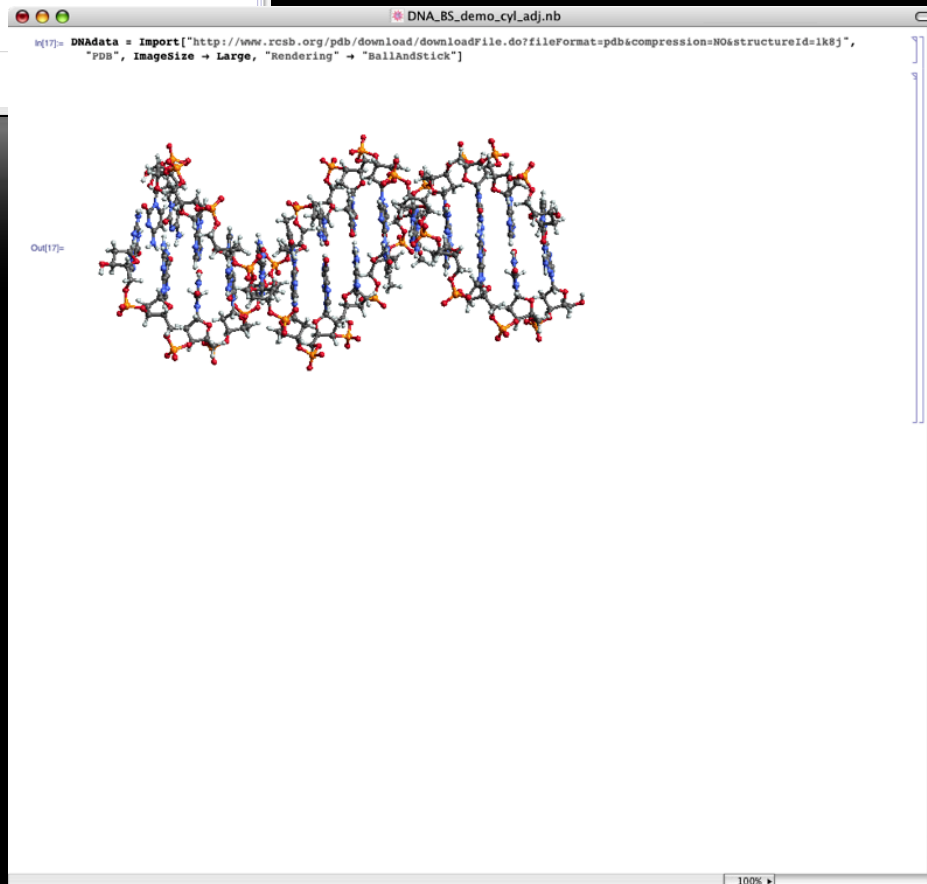


Ball and stick from
Mathematica .nb file

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

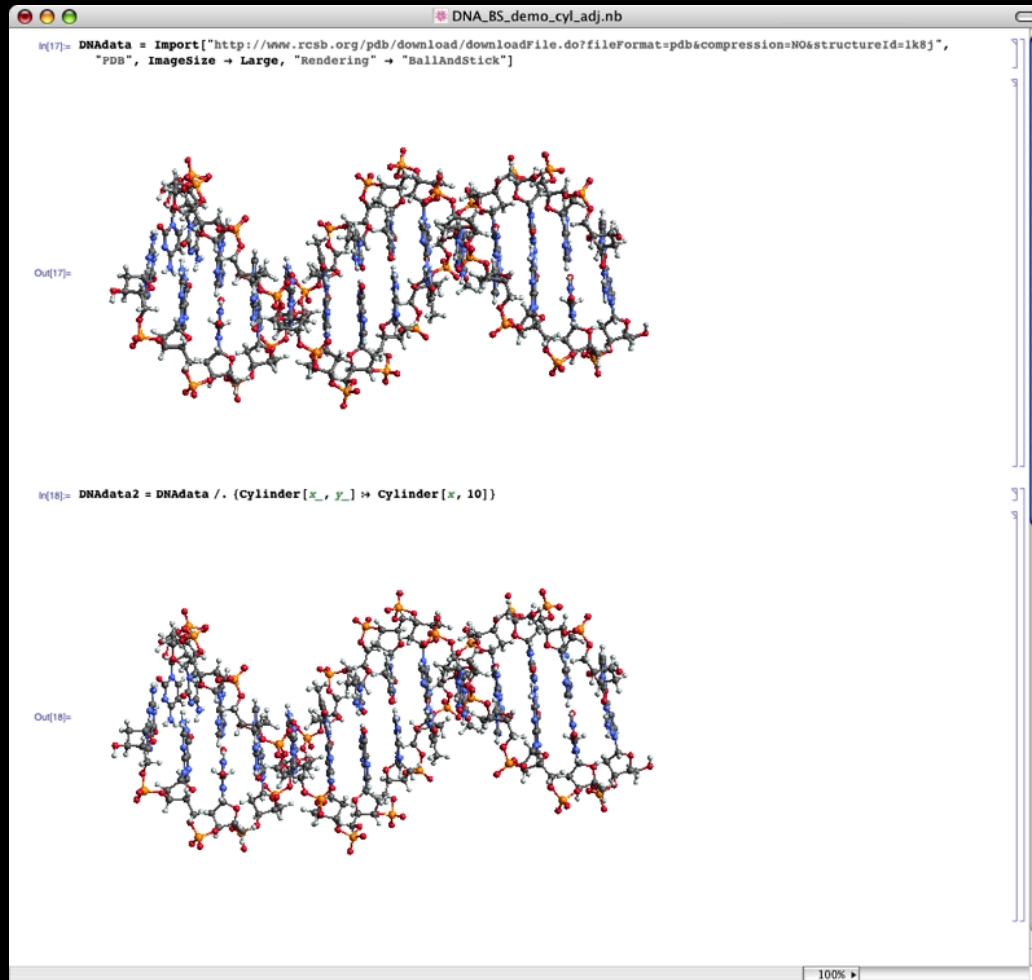


Ball and stick from
Mathematica .nb file



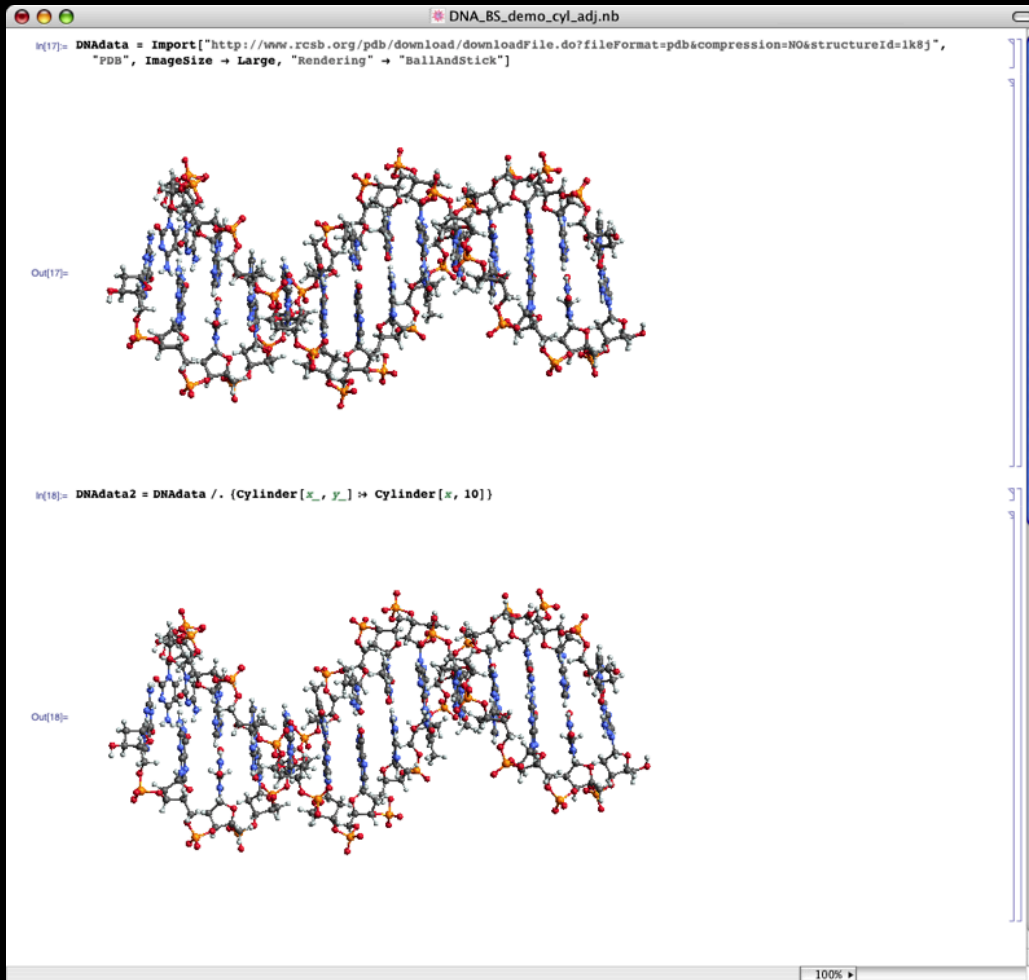
Adjusting orientation within .nb file. You can **ensure** that the information is presented exactly according to **your specifications** because you placed it yourself.

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



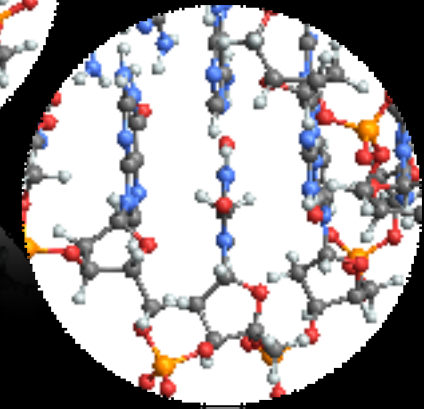
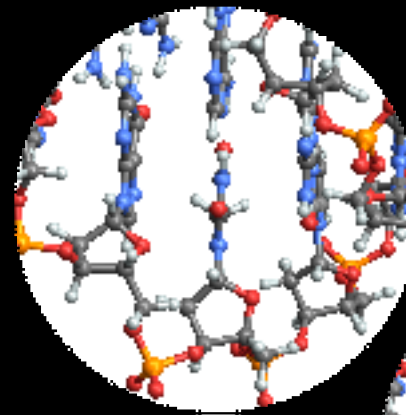
Content owner has control over many details. Make any final adjustments to the data, while it's all still stored in *Mathematica* and can be easily adjusted.

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

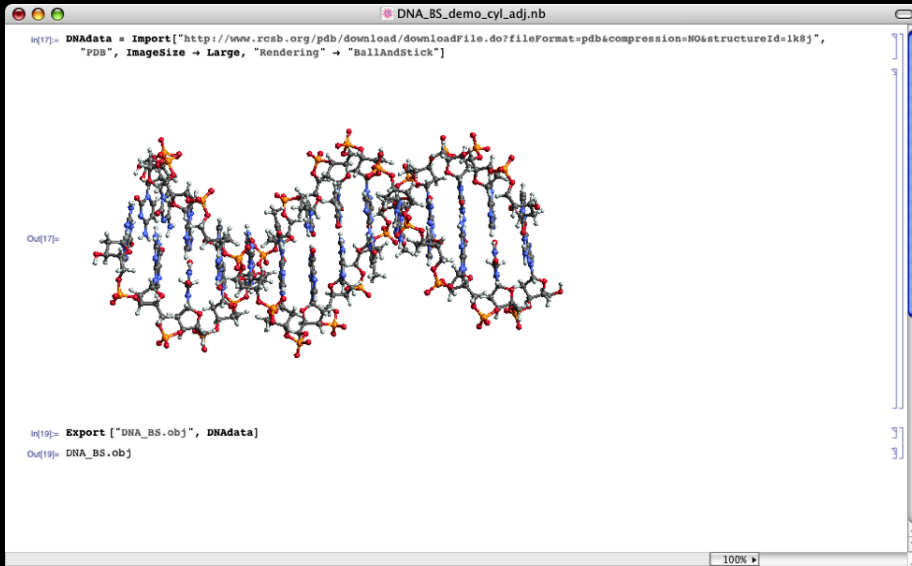


Content owner has control over many details. Make any final adjustments to the data, while it's all still stored in *Mathematica* and can be easily adjusted.

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

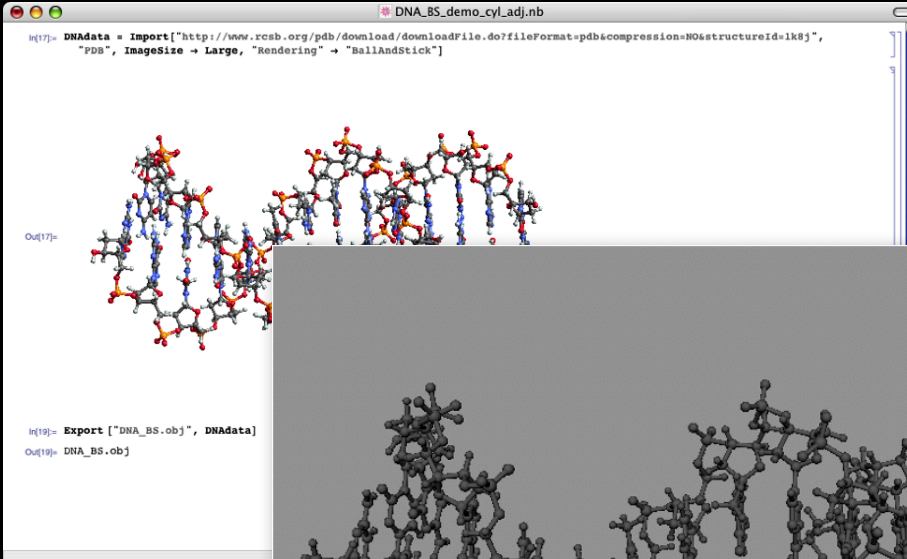


Case Study Three - Using *Mathematica* for 3D Content



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.

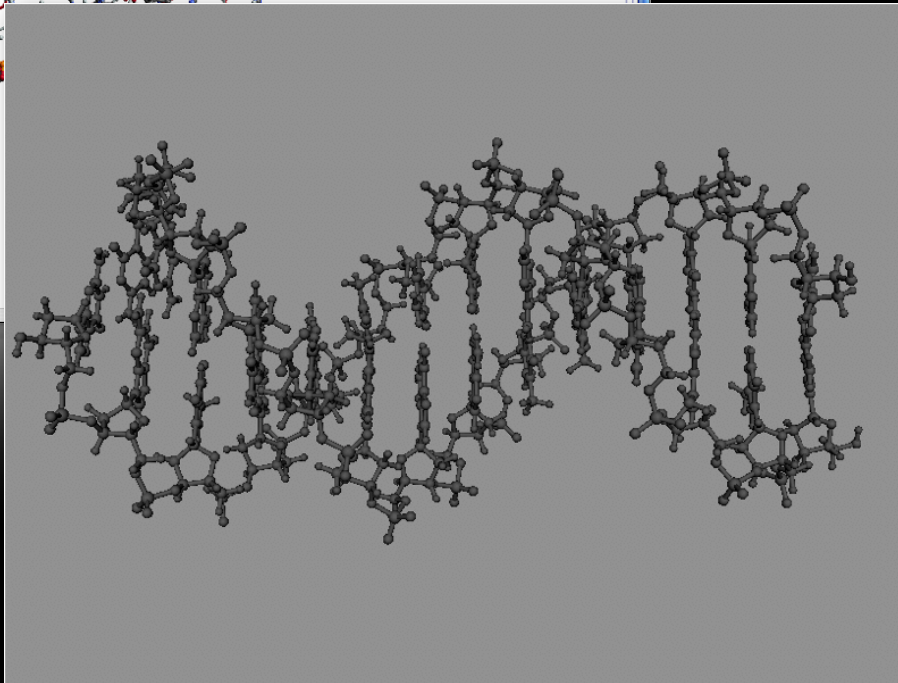
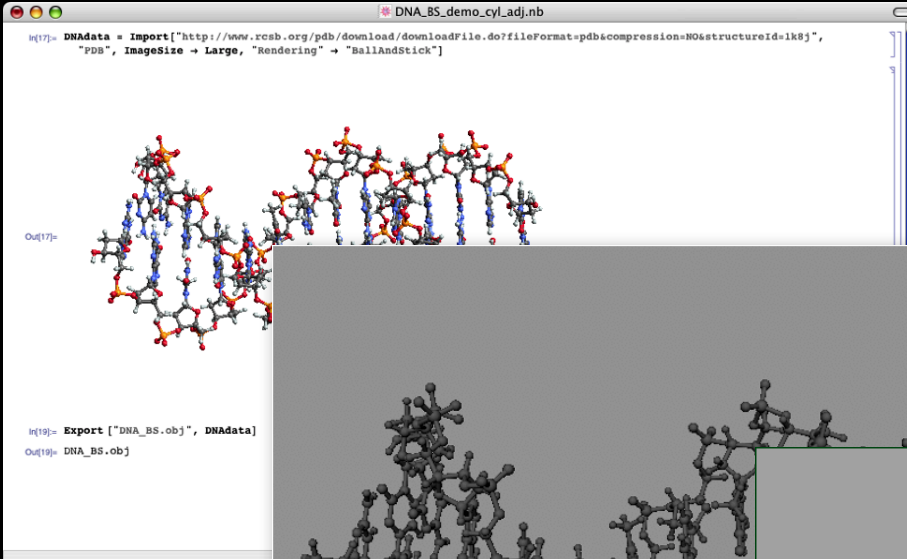


Image as imported by Maya

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



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

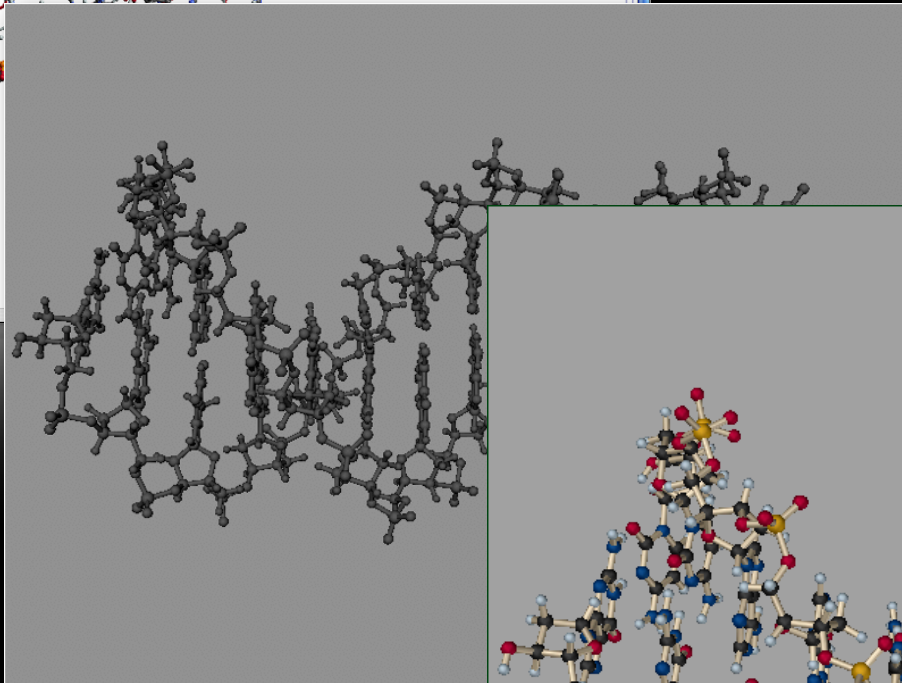
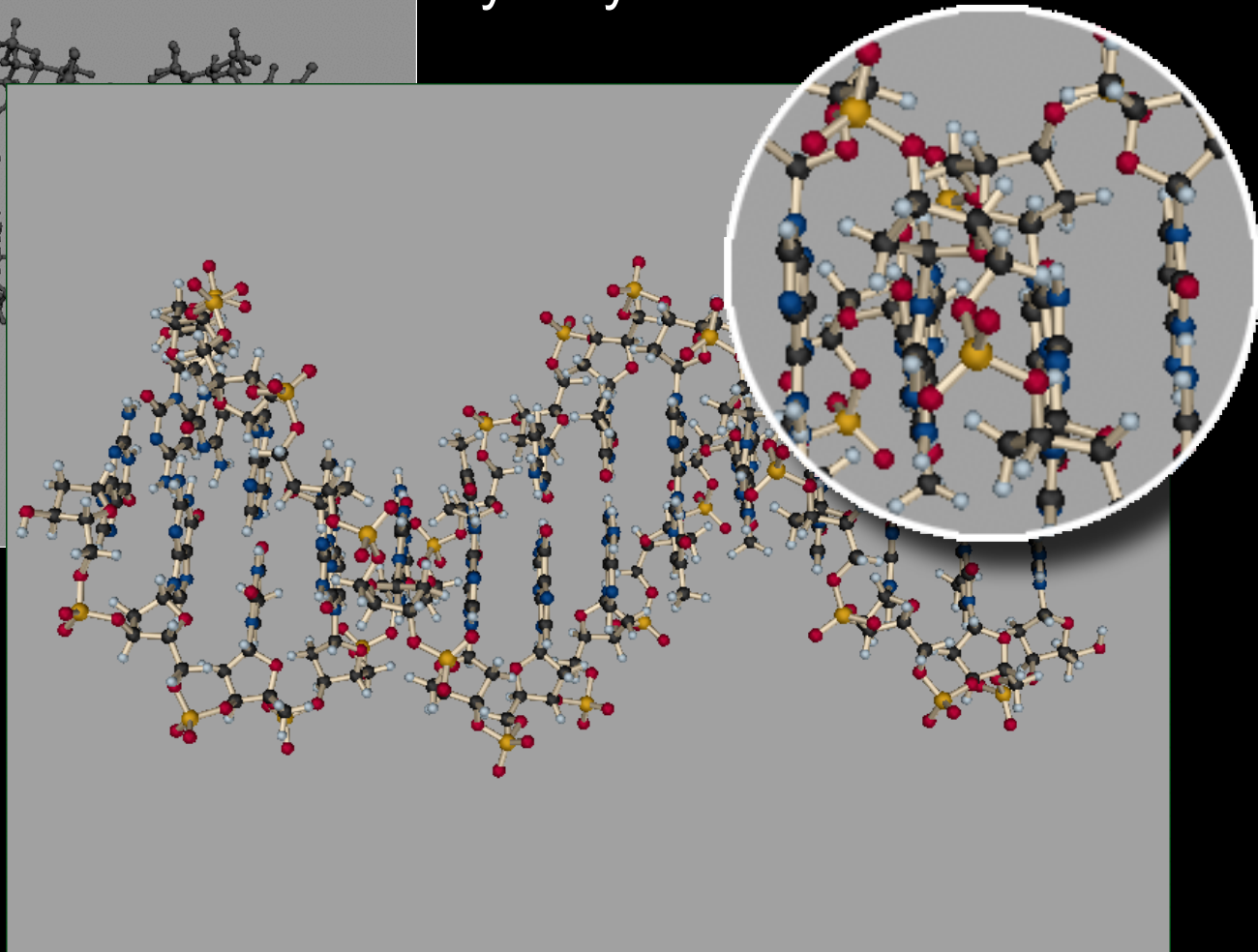


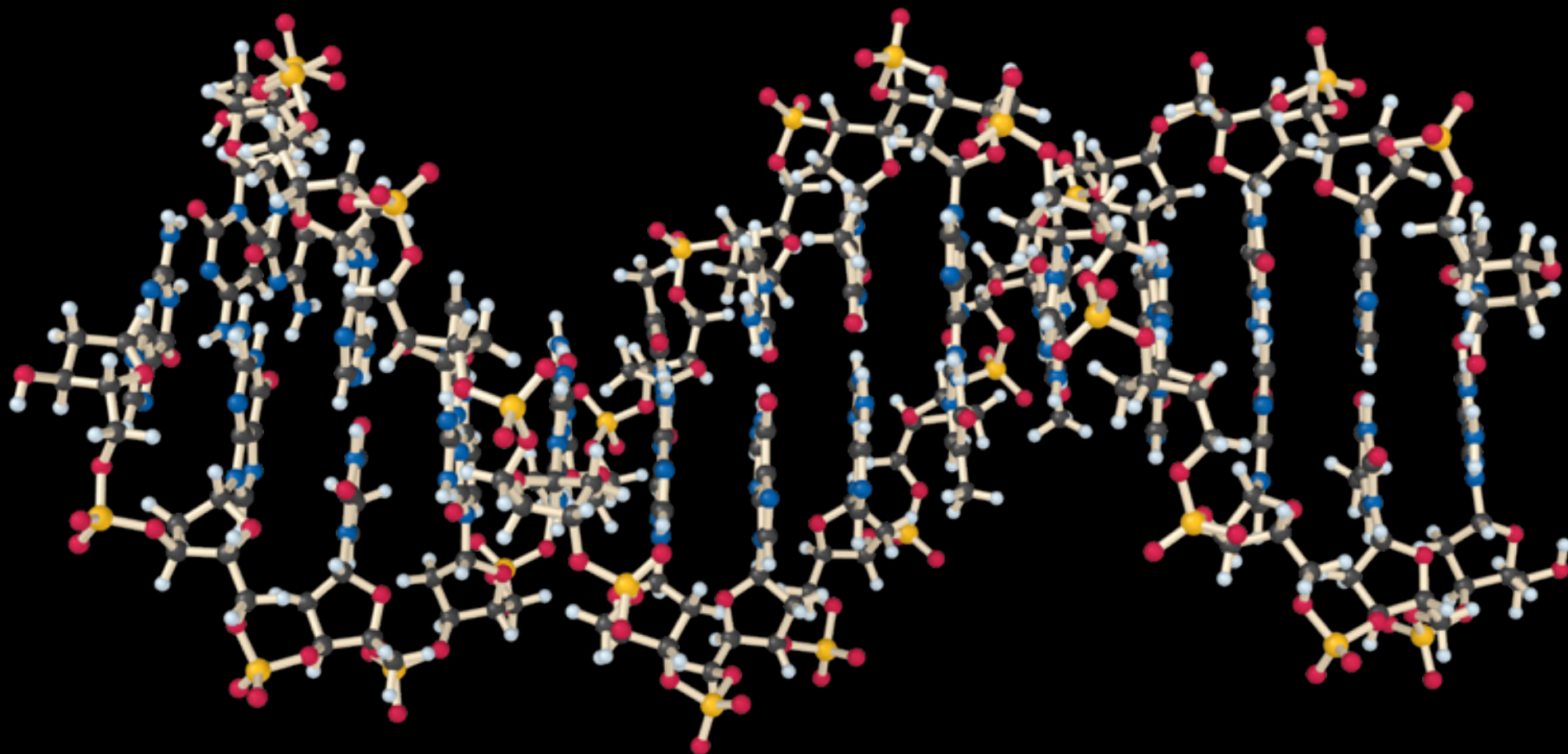
Image as imported by Maya



Color and shading added in Maya

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

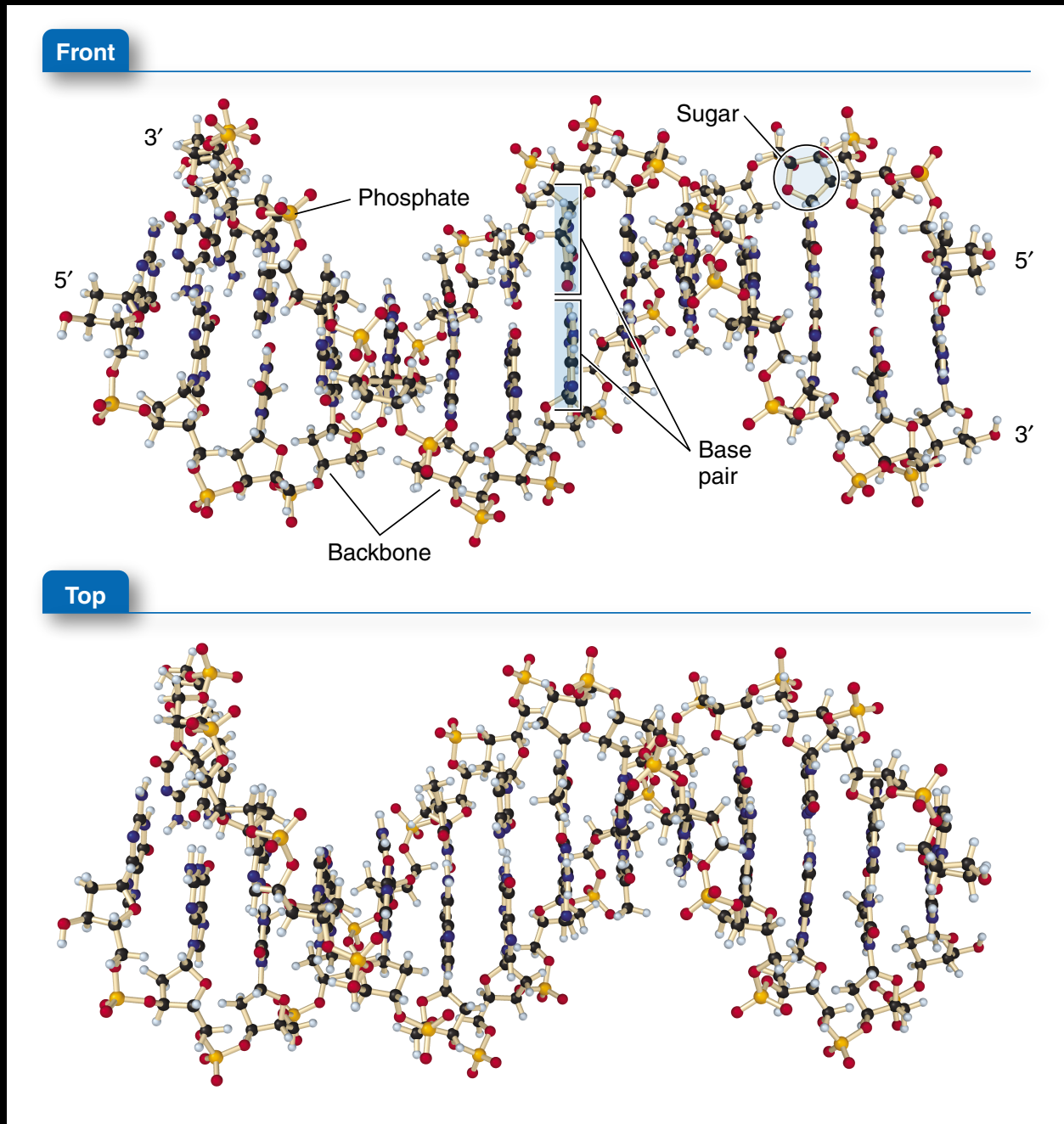
Rendering image in Maya for use in print once color and texturing are set up in book style.



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

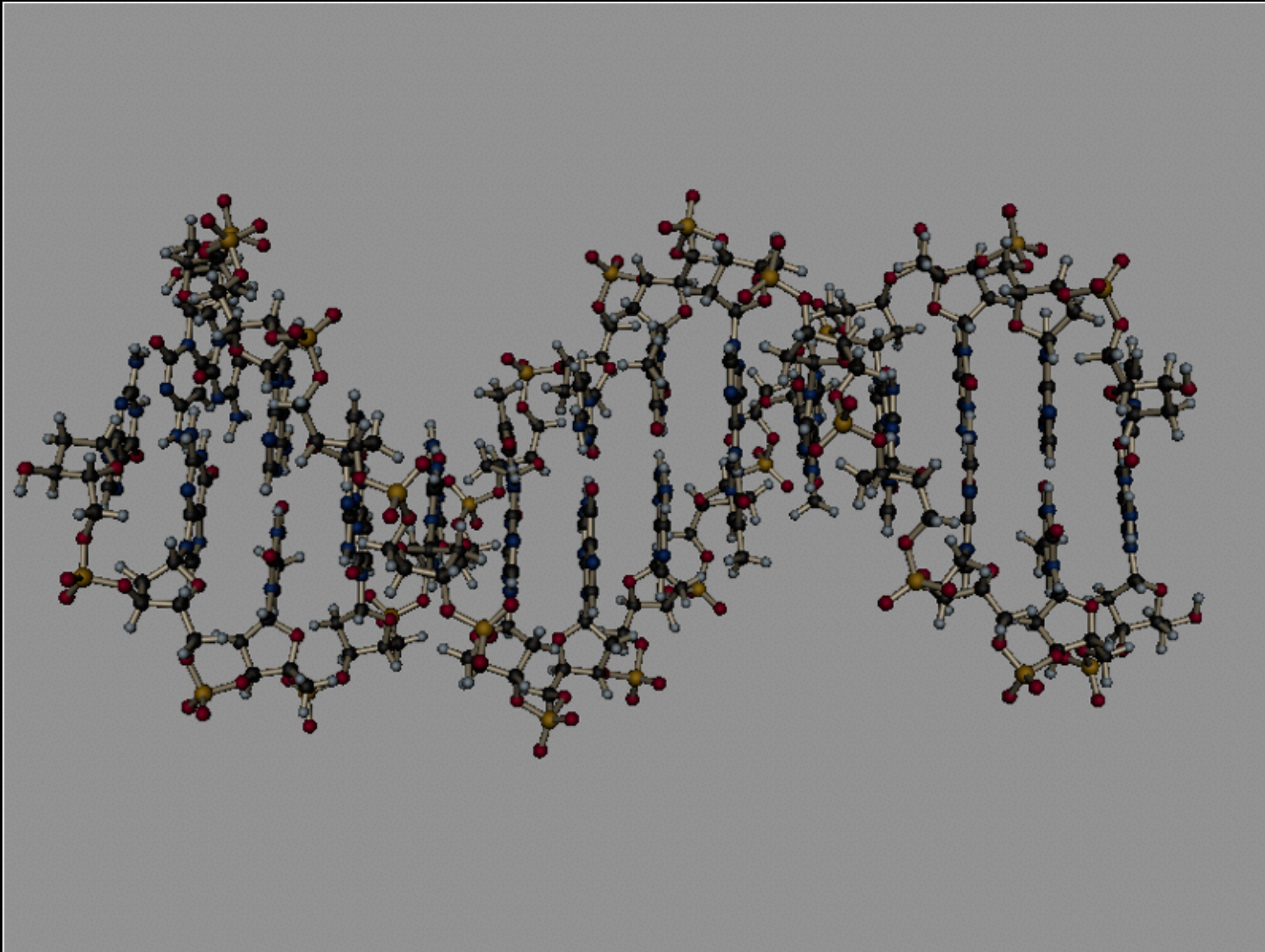
Final printed image

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.



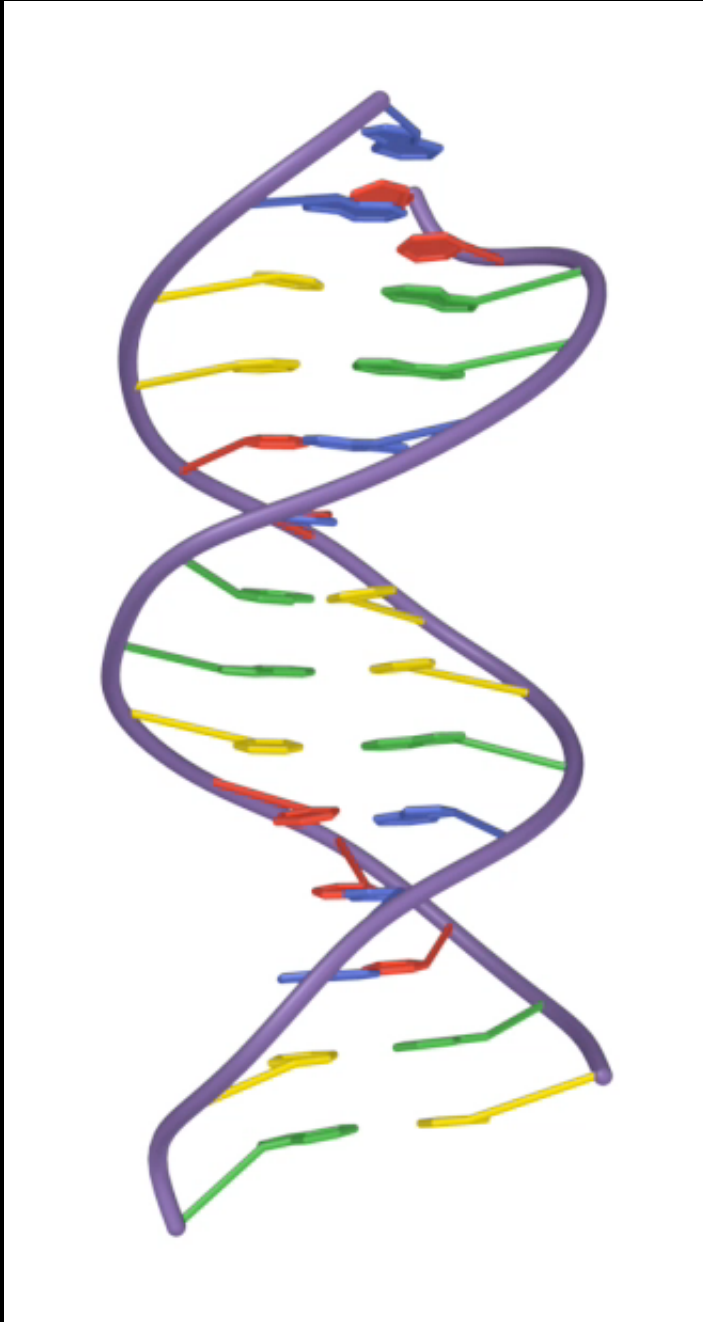
Case Study Three - Using *Mathematica* for 3D Content

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
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Thank you



PRECISION GRAPHICS

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jtroutt@precisiongraphics.com