Overview

Biological family trees are used by scientists to show how different living things are related to each other. But this same format can be used to show other relationship types! Can you create your own piece of artwork that is based on a biological family tree?

Design challenge: Explore biological family trees by making your own series of drawings that gradually change and branch.

Materials

Don’t just limit yourself to the items on this list. Use whatever you have on hand — be creative!

<table>
<thead>
<tr>
<th>Drawing supplies</th>
<th>Connecting supplies</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Paper</td>
<td>● String</td>
</tr>
<tr>
<td>● Pen/pencil</td>
<td>● Tape</td>
</tr>
<tr>
<td>● Markers</td>
<td>● Pipe cleaners (chenille stems)</td>
</tr>
<tr>
<td>● Online coloring pages</td>
<td>● Wire</td>
</tr>
</tbody>
</table>

Introduction

Biological family trees (phylogenetic trees) show relationships. They’re used to group and categorize items. They’re most commonly used in genetics to show how species are related to each other. This can help scientists figure out where different species came from! A tree like this shows how different species of lizards are related to each other.

In this tree, brown anoles are grouped together with green anoles. This lets you see that those lizards are closely related to each other! And if you go farther up the tree, you’ll eventually reach a branch that leads to komodo dragons. Anole lizards are still related to komodo dragons, but they’re more distant relatives.

This type of tree can be used to show all sorts of relationships! Here’s one way you could group school supplies into a relationship tree based on their similarities and differences:

© The Tech Interactive. This is a prototype activity. Proceed with innovation. If you have feedback regarding this activity, please email beta@thetech.org.
Design challenge: Create a Tree of Art
This can be done on your own, or with a group of friends. It’s like a game of telephone, but with art!

1. Start with a single drawing. It can be anything you like!

   ![Original image]

2. Make a copy of the drawing, and change one to two things.

   ![2nd image]

3. Now, connect the new drawing back to the “parent”.
   - If it’s on the same paper, connect them with a line. If it’s on a new sheet, connect with tape or string!
   - Give your tree more branches by making two new versions from a single “parent” drawing.

   ![Branches]

4. Keep going until you’ve run out of space, or until you’ve created a tree design you like.

5. Admire your final creation, hang it on the wall, and see how much your original drawing evolved!

Tips and ideas

- Want to do it with friends? Text around photos of your artwork or send a digital coloring page back and forth! We like [aggie.io](http://aggie.io) for collaborative art, but there are lots of options.
- Don’t want to draw? Try making sculptures or pipe cleaner creations instead to make a unique mobile.
- Forgot to connect or organize them along the way? See if you can recreate the order just from the final art pieces.

Bonus challenge: Make a different shape
These types of trees can be represented in many different ways. As long as the lines and connections stay the same, you can turn it into many different shapes. Here are 4 ways to arrange the same lizard tree:
Explore more: Create family trees!
There are sometimes multiple ways to solve these. One possible solution to each is included at the end of this guide.

Puzzle 1: Shapes
How would you group these shapes? Can you put them into a relationship tree? We recommend cutting them out so you can move them around, then connecting them with tape or string!

Puzzle 2: Frog family tree
These types of trees are most often used to show how species have changed over time. Each branchpoint shows when something new happened, or a change was made. By comparing similar animals, you can sometimes figure out what their shared ancestor may have been like.

Here are eight related frogs. They share a single great-grandparent: the Great-Grandfrog! Can you color in their family tree (Page 5), and figure out what the Great-Grandfrog may have looked like?

Hint: Each frog baby will have only one difference from its parent. Try to find the pairs of siblings first, since they're the most similar to each other. Then try to match them to their cousins!
Puzzle 3: Assemble a Tree of Life
The frogs you just looked at are close relatives. But you can make similar “family trees” for distant relatives as well! For example, you can group entire species to see how they are related to each other. Just like with the frogs, you can observe and compare different species. Shared physical features can help you decide how to group them! Today, scientists usually compare the DNA sequences of animals to more accurately assemble them. This is even more accurate than comparing physical features … but it’s a little hard to look at their billions of DNA letters on a tiny piece of paper, so we’re just giving you a tiny sequence from each animal.

There are 16 different animals on Page 6. Can you assemble them into a family tree based on shared features? We recommend cutting them out so you can move them around, then connecting them with tape or string!

Bonus Challenges
Looking for even more stuff to do? Here are a few ways to keep exploring!

Make a puzzle for a friend to solve
Create a relationship tree. It could be based on a drawing, a word, common household items, a secret message, or whatever else you can think of! Make a list of the items you used in your tree, and send them to a friend. Is your friend able to assemble them into a relationship tree? Is it the same as the tree you created with those items?

Be ready to provide hints! If your friend is struggling, it can help to give hints on why you might have grouped certain items together.

Color a different frog family tree
Print out the frog page and add in your own colors! Start by coloring in the Great-Grandfrog, and work your way down. Remember: each frog baby only has one difference from its parent.
Grandfrog
Great
color the frog family tree!
Puzzle solutions

Shapes
There are lots of ways to arrange these — maybe yours is based on colors and patterns!

Frog family tree
There are a few correct ways to color the Great-Grandfrog. Sometimes you have to make a “best guess” based on the information you have available!

Tree of Life

Share Your Results! Keep us posted about your design challenges on social media with #TheTechatHome.