Resource adapted by
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Bingo Chip Genetics

(adapted from Pasta Genetics lesson from The GENETICS Project - https://gsoutreach.gs.washington.edu/)

Grades: 5th Grade (NGSS – 3rd Grade)

Arizona Science Standard (NGSS Correlations)

5.L3U1.9 (NGSS-P: 3-LS3-1) **Obtain, evaluate, and communicate** information about patterns between the offspring of plants, and the offspring of animals (including humans); **construct an explanation** of how genetic information is passed from one generation to the next.

Estimated Time: 60 minutes

Materials

For Each Student (or group of 2-3 if they can share materials):

8 bingo chips of color 1
8 bingo chips of color 2
8 bingo chips of color 3
8 bingo chips of color 4
1 extra fine point permanent marker
1 sealable plastic bag (4”x6”)
1 six-sided die (or type “Google Dice” into Google for online die)
1 copy of Bingo Chip Genetics Handout
Colored markers or pencils to match the color of the bingo chips

Advanced Teacher Preparation for In-Person or Remote with Supplies

Prepare bags of bingo chips and an extra fine permanent marker for each student with four sets of 8 bingo chips in four different colors. For example – 8 red, 8 green, 8 blue, 8 yellow. For students in the classroom, you can make a hard copy of the Bingo Chip Genetics handouts (pages 4-5: double-sided, pages 6-7: single-sided – these could be laminated for reuse with dry erase markers). For remote with supplies, you can decide if you are going to use hard copies or use the interactive student notebook. Either print the phenomenon picture on page 8 or use it in a presentation to engage students to notice and wonder about it before you start the lesson.

Advanced Teacher Preparation for Fully Remote

Send each student a copy of the interactive student notebook.

Essential Question: What is the genetic relationship between parents and their children?

Investigative Phenomenon:

The picture at the end of this document can be used as the phenomenon for this lesson. Before beginning, and without sharing that the lesson will be about genetics first, ask students to write down what they notice and wonder about the picture. At the end of the lesson, during the discussion, this image will be revisited and you will reveal that the girls are full biological sisters with the same parents.

Completely Virtual Adaptation

In the case you can’t get students supplies, you could virtualize this lesson completely. These details will be coming soon.

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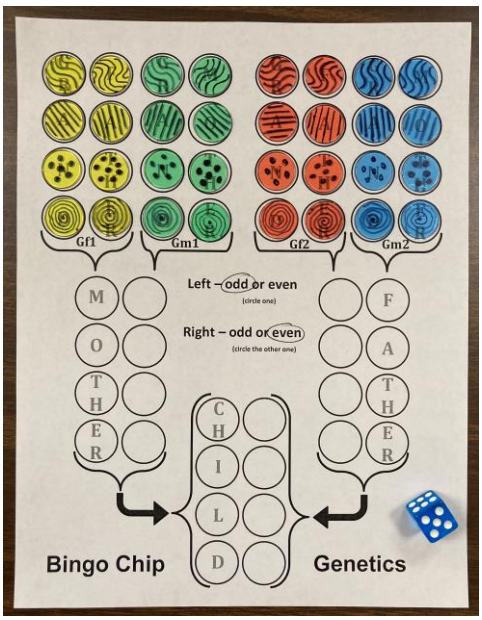
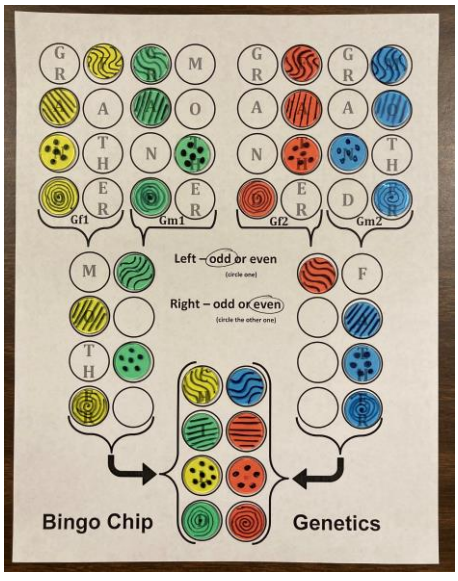
Bingo Chip Genetics – Student Directions (with bingo chips)

1) Sort out the bingo chips by color and confirm you have eight of each color.
2) Decide on four different patterns you will use on the chips and use your permanent marker to draw those patterns directly onto the bingo chips. Be sure that two of each color have the same pattern drawn on them to indicate they are gene pairs. An example is given to the right. The color of your bingo chips and the patterns you decide to use can vary.

3) Next, place the bingo chip gene pairs into place for each grandparent on the handout as shown below.



4) Circle odd or even next to Left and the opposite one next to Right in the middle of the page. This will determine which side of the gene pair you will select when rolling the die.
5) Starting with Grandfather 1 on the left, roll the die. As shown in the example, if the number on the die is odd, select the gene in the pair on the left. Otherwise, if the number on the die is even, select the gene in the pair on the right.
6) Place the gene into the column indicated for where Grandfather 1's genes are passed on to the mother.
7) What do you notice? What do you wonder?
8) Repeat the same process for each grandparent.
9) Explain why rolling the die was not critically important in determining the genetics of the mother and father.



10) Now that you have the gene pairs for the Mother and Father, roll the die to determine which genes the mother will pass onto the child and which genes the father will pass onto the child. A complete example is shown to the right.

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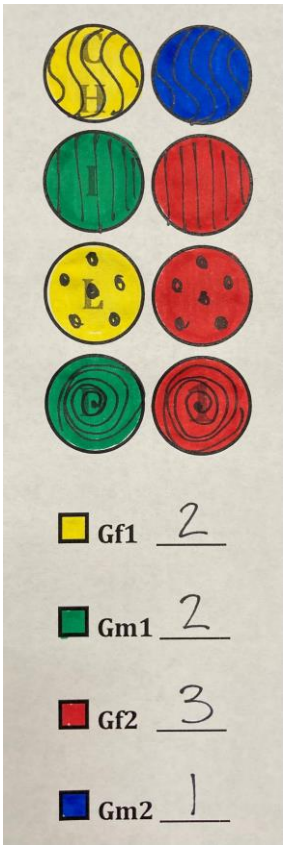
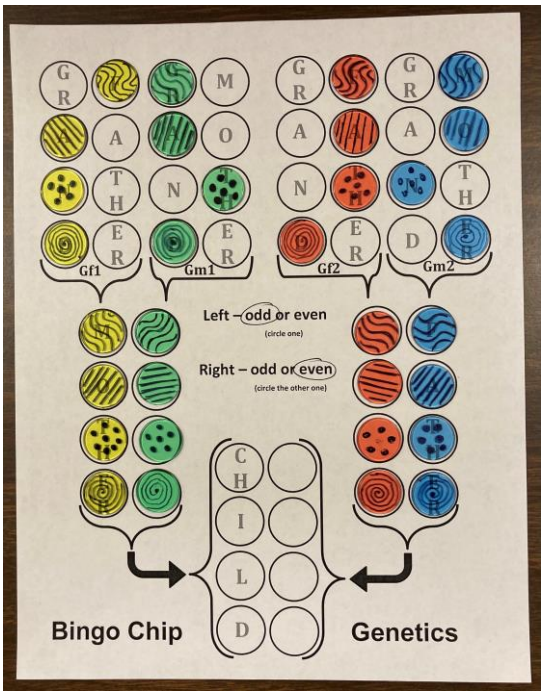
11) Record the gene pairs for the child on the children handout by coloring in the gene pairs to match the child's genetics. Include the patterns on the genes and record how many genes came from each grandparent. An example based on the child's genetics on the last page is shown to the right.



12) Reset the mother's and father's gene pairs by returning the genes from the child to the parents, as shown below. Then roll the die and create another child. Repeat until you have four children total and be sure to record the genes and data on the Children handout.



13) Once you have four children, answer the notice and wonder questions and then use the group discussion questions to discuss with your classmates.

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Notice and Wonder Questions

1) How many genes did each child inherit from Mother? From Father?

2) How many of each kind of gene (pattern design) does each child receive?

3) Did any of the four children have exactly the same combination of genes? What does it mean if you have a perfect match?

4) Did every child get at least one of their genes from each grandparent? Is it possible a child could have no genes from one of their grandparents?

5) Would it be possible for a child to have all eight genes from Grandmother 2? Why or why not?

6) Would it be possible for a child to have four genes from Grandfather 1 and four from Grandmother 1? Explain what would have to happen for this to occur.

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Group Discussion

7) Where did the four grandparents get their genes?

8) Would you be suspicious if another student claimed all four of their bingo chip children had the same combination of genes? Why or why not?

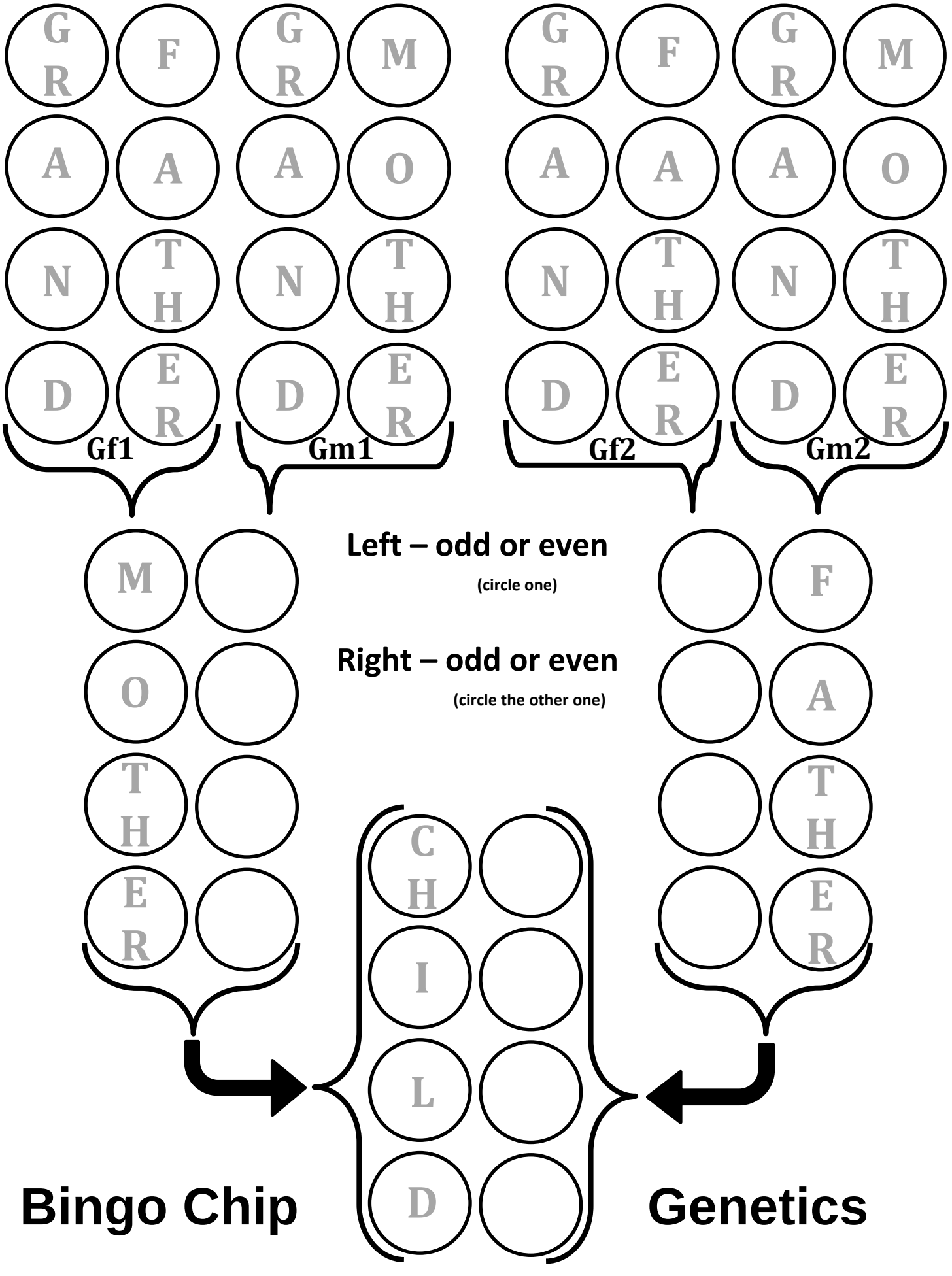
9) Scientists estimate that we each have about 21,000 genes, which come in pairs. How many genes did you get from your mother? From your father?

10) In real life, do you think it would be possible for a mother and father to have two children from different pregnancies with the same combination of 21,000 genes?

Applying What You Know to the Phenomenon

11) What is surprising about the girls in the picture? What must be true about their genetics?

12) Which two children on your page would best model the girls in the picture and why?


GR
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Gf1
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A
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TH
N
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D
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D
ER
Gf2
Gm2
Left – odd or even
(circle one)
Right – odd or even
(circle the other one)
M
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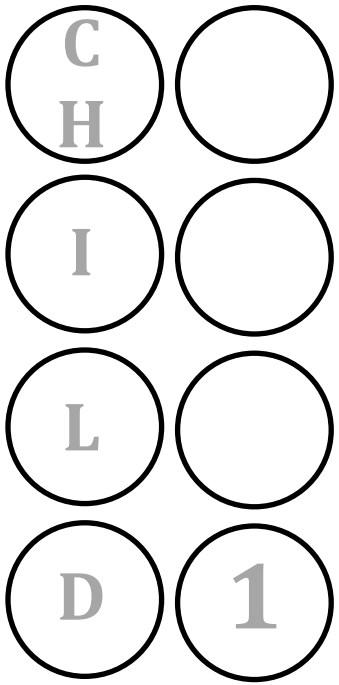
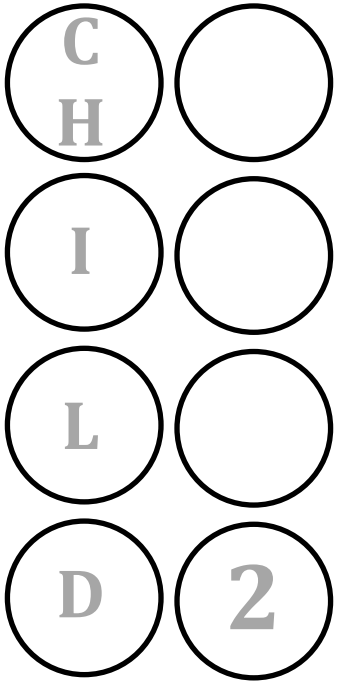
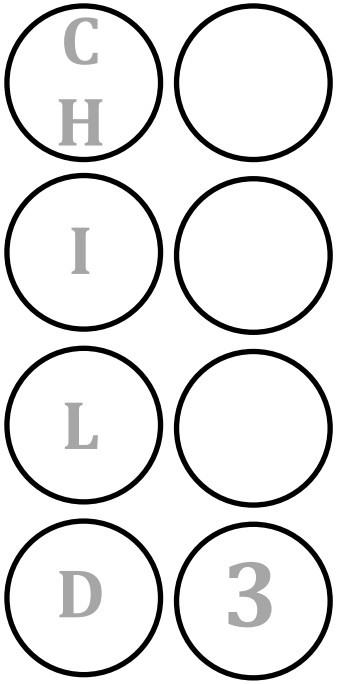
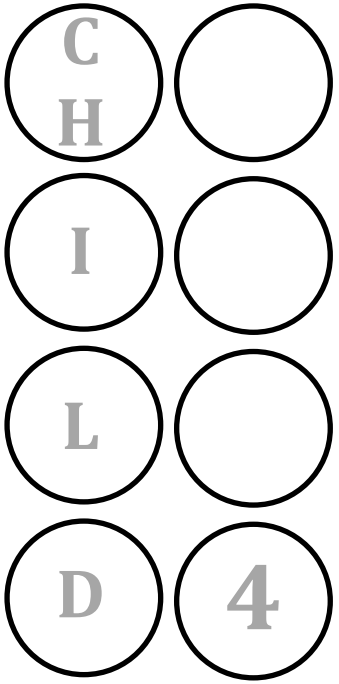
Bingo Chip
Genetics

Bingo Chip Genetics - Children









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☐ **Gm1** _____ ☐ **Gm1** _____ ☐ **Gm1** _____ ☐ **Gm1** _____

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What do you notice? What do you wonder?

Reference: http://bit.ly/TwoGirlsPhenomenon