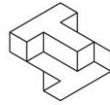


# InGen: Dino Genetics Lab

Lab Related Activity: *DNA and Genetics*



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This activity is meant to extend your students' knowledge of the topics covered in our DNA and Genetics lab. Through this activity, pairs of students will play with dominant and recessive alleles to create a new creature.

**Grade Levels: 5-12**

**Estimated Time: 30-45 minutes**

Student Outcomes:

1. Students will be able to interpret homozygous and heterozygous alleles, and dominant and recessive alleles to create hypothetical creatures.
2. Students will be able to explain how meiosis and fertilization result in the transmission of genes through generations.

### **Next Generation Science Standards**

*Life Science:*

**Grade 6-8:** MS-LS3-2, MS-LS1-5,

**Grade 9-12:** HS-LS3-1, HS-LS3-2, HS-LS3-3  
HS-LS4-2, HS-LS4-3

### **California Science Content Standards**

*Life Science:*

**Grade 7:** 2.b-d; **Grade 9-12:** 2.a-g, 3.a-b

### **Common Core ELA Standards**

**Grades 4-5:** *Writing* W.7; W.8

**Grade 4:** *Speaking and Listening* 4.SL.1b-d

**Grade 5:** *Speaking and Listening* 5.SL.1b-d

**Grades 6-8:** *Writing* W.7; *Speaking and Listening* SL.1b-e

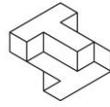
### **Vocabulary:**

*Familiarity with these terms and concepts will enhance students' experience in the activity.*

- **Allele:** alternative forms of a gene for each variation of a trait of an organism.
- **Dominant:** observed trait of an organism that masks the recessive form of a trait; symbolized by an upper case letter.
- **Fertilization:** fusion of male and female sex cells (gametes).
- **Gene:** the basic physical unit of heredity.
- **Genotype:** combination of genes in an organism.
- **Heredity:** passing on of characteristics from parents to offspring.
- **Heterozygous:** when there are two different alleles for a trait.
- **Homozygous:** when there are two identical alleles for a trait.
- **Recessive:** trait of an organism that can be masked by the dominant form of a trait; symbolized by a lower case letter.
- **Phenotype:** outward appearance of an organism, regardless of its genes.
- **Trait:** a genetically determined characteristic or condition, like hair color, dimples, or sex

### **Materials:**

- Jumbo Popsicle Sticks [wood color]
- Red Jumbo Popsicle Sticks
- Blue Jumbo Popsicle Sticks
- Dark Green Printed Dinosaur Parts
- Light Green Printed Dinosaur Parts
- White Printed Dinosaur Parts
- Glue Sticks
- Scissors
- Markers
- Student Handout/Worksheet
- Large White Paper (legal or larger)



### Prep and Setup

- Pre-count the red and blue popsicle sticks so that half of the class will receive a red stick and the other half will receive a blue stick. These will be randomly passed out to students and will represent the sex of their dinosaur.
- Photocopy the dinosaur parts so that each student will have one full set. Print parts on an assortment of paper: dark green, light green, and white. Each student should receive all their dinosaur parts in the same color.
- Photocopy enough Dino Genome Reference Sheets and Genotype/Phenotype Grids for each student to receive one.

### Procedure:

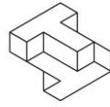
1. Pass out either a red popsicle stick or a blue popsicle stick (there should be equal red and blue popsicle sticks passed out) and a complete packet of dinosaur parts to each student.
2. Each student will create their dinosaur by cutting out the pieces and gluing them together. Remind students to pay close attention to the directions next to each dinosaur part. *Hint: Leave extra paper at the open ends of the appendages. Glue all the parts of the dinosaur together and then glue the dinosaur to the paper.*
3. Review how traits are coded in genes and how phenotype and genotype are related. Particular focus should be placed on dominant and recessive alleles. Also, review how genes are coded on sex chromosomes and how the genes on the sex chromosomes are expressed.
4. Pass out a Dino Genome Reference Sheet and a Genotype/Phenotype Grid to each student. Work with students to construct the genotype of their dinosaurs and to record it on their worksheet.
  - a. Students can decide whether or not dominance is heterozygous or homozygous, but encourage them to experiment with both options.
  - b. Ensure alleles are accurately assigned to the sex chromosomes – red sticks represent female and blue sticks represent male.
5. Give each student 5 wood-colored popsicle sticks – one for each trait represented in their dinosaur. Students should record each trait on one popsicle stick, with one allele on each side. For example: On one stick I would record “C” on one side and “c” on the other side for my dinosaur with dark green skin. On my second stick I would record “A” on one side and “A” on the other side for my dinosaur with normal skin pigment.
6. Work with students to accurately record the dinosaur’s sex-linked traits on the red/blue popsicle sticks, including “x” and “y”. For the red stick, write an X on each side of the stick; for the blue stick, write an X on one side and a Y on the other. The X side of the blue stick will also have the allele for the headsail.
7. Once students have finished recording the genotype on the popsicle sticks and on their grid, have them pair up with someone who has a dinosaur of the opposite sex and discuss the genotype and phenotype of their created dinosaur.
8. The pairs of students will then create a baby dinosaur based on the genes of their dinosaurs: Both students will drop their bundle of popsicle sticks and pair up the alleles that land face up. They will record the baby dinosaur’s genotype and phenotype on the Grid.
9. The pair will then construct an image of their baby dinosaur based on the resulting genotype.

### Discussion

- What is a phenotypic trait that is present in all members of the imaginary dinosaur family? Why did this occur?

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- Are there any phenotypic traits that appear in one generation but not in another, or vice-versa? Why did this occur?
- If your dinosaur mom and dad had a second baby, would it exhibit the exact same traits as the first? Why would the two baby dinosaurs be similar or different?
- Will all of your couple's daughters have horns? Will all of your couple's sons have sails? What is the genetic evidence for this?
- In what way does this simulation not accurately demonstrate the biological reality of inheritance?
- What advantages does the baby dinosaur have because of its genetic code? Are these advantages dependent on anything other than its genetic make-up?
- How might the environment influence the baby dinosaur's phenotypic traits? What phenotypic traits might be most affected by the environment?

## Extended Learning

- Add additional traits, including those that are incompletely dominant.
- Construct Punnett Squares to determine probability of an offspring's genotype/phenotype.
- Make bar graphs of the phenotypic traits for each generation of dinosaurs and compare and contrast.
- Discuss how environmental and genetic factors affect the growth and the probability of successful reproduction. Run a scenario in which the dinosaurs are placed into different hypothetical environments; determine which dinosaurs are most likely to reproduce and which genes are the most likely to survive.



## Dino Genome

	Dominant Alleles	Recessive Alleles
	<b>B</b> has short tail <b>N</b> has long neck <b>C</b> has green skin*	<b>b</b> has long tail <b>n</b> has short neck <b>c</b> has light green skin*
	<b>A</b> normal skin pigment <b>R</b> pointed spikes	<b>a</b> completely white <b>r</b> rounded spikes
X Chromosome	<b>H</b> has horn on nose	<b>h</b> hornless
Y Chromosome	<b>M</b> male sex (results in head sail)**	

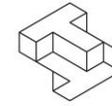
\*If a dino is **aa** and therefore unable to make skin pigment, it will have white skin regardless of what alleles it has for skin color.

\*\*If the male dino passes on an X chromosome with the M allele for headsail, the female X chromosome with no allele for headsail will be dominant over the M allele for headsail.



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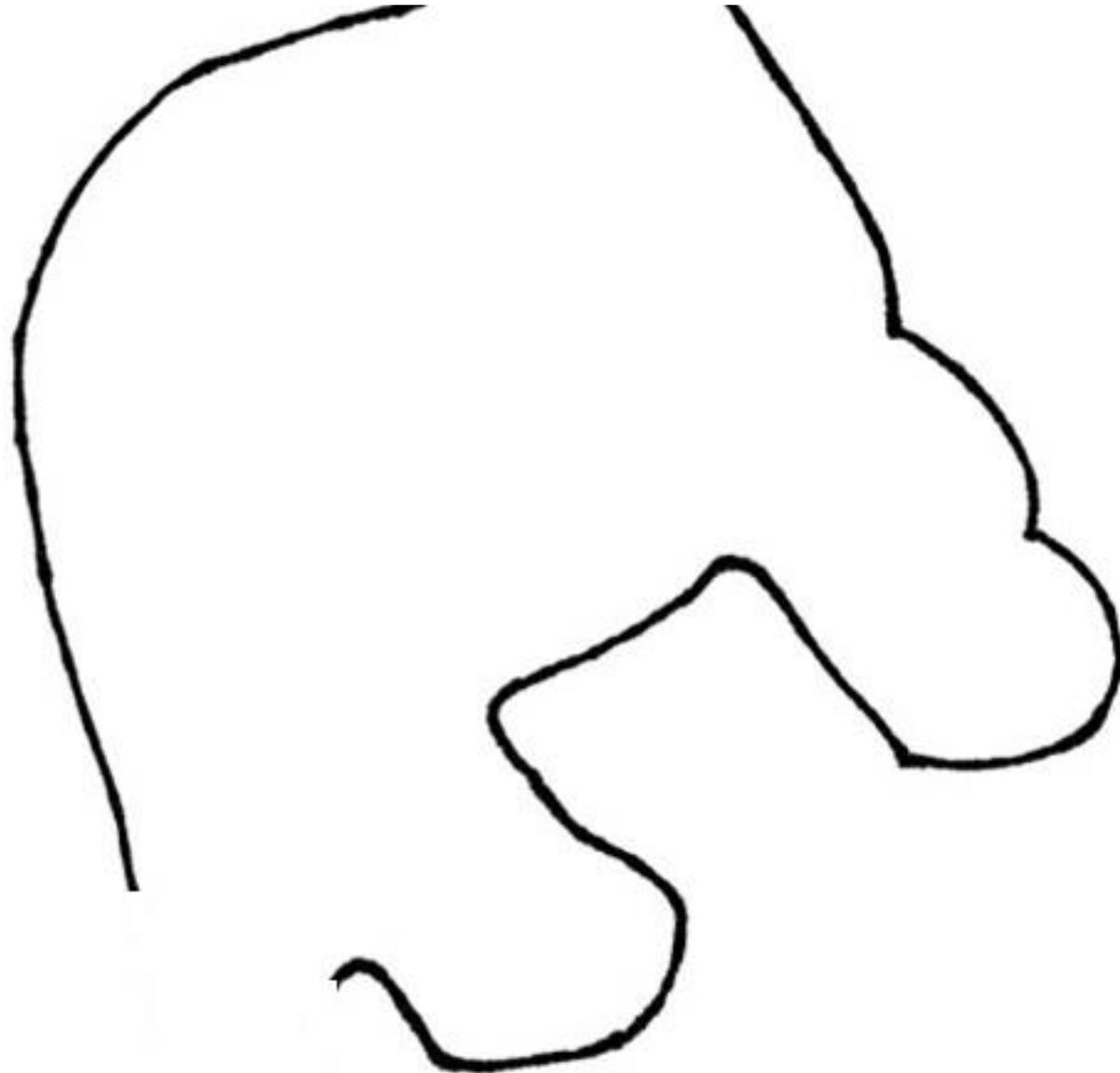


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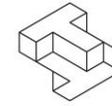
## Dinosaur Body:

Everyone must have a dinosaur body.



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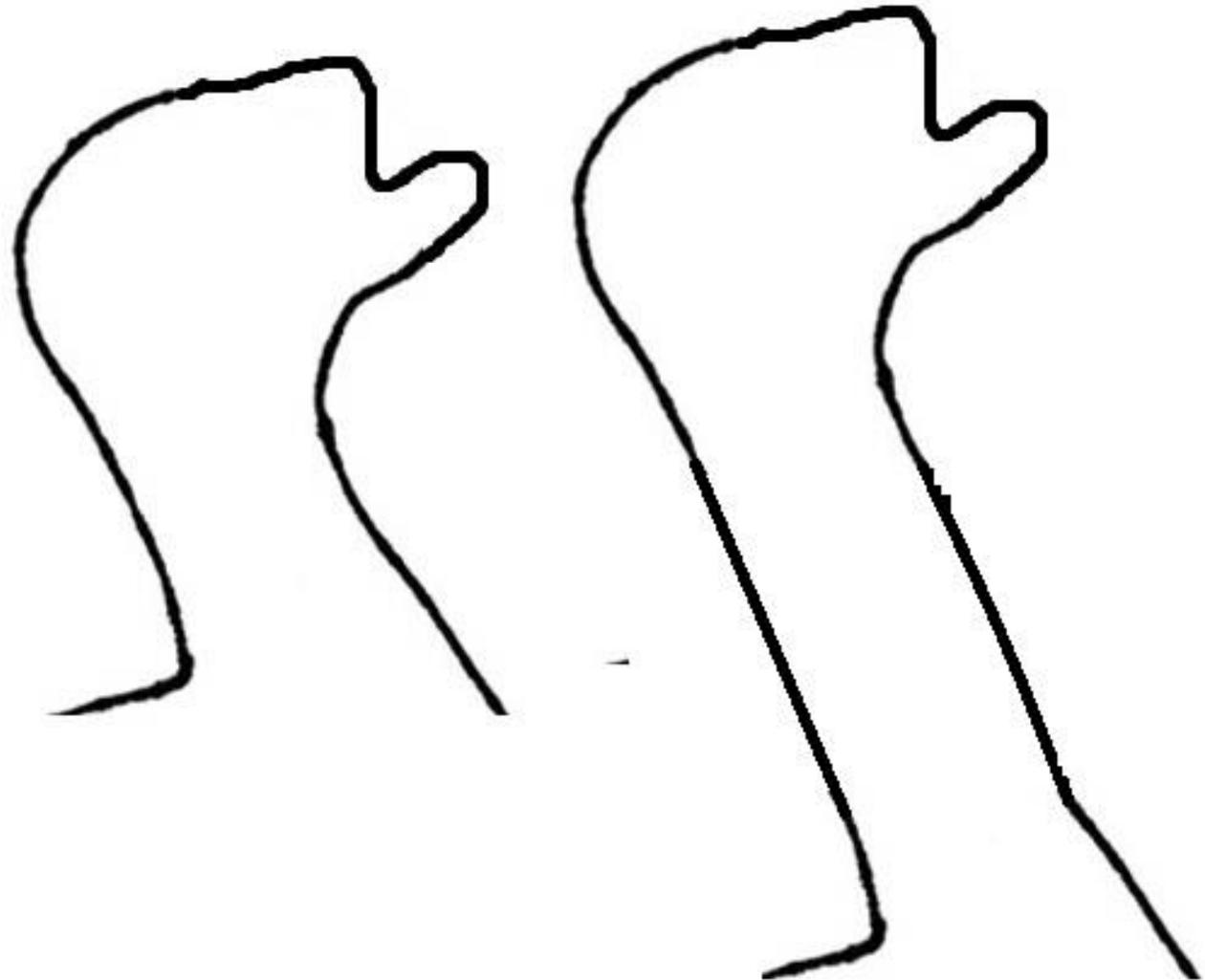


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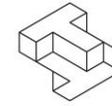
## Dinosaur Neck:

Everyone must choose either a long neck or a short neck.



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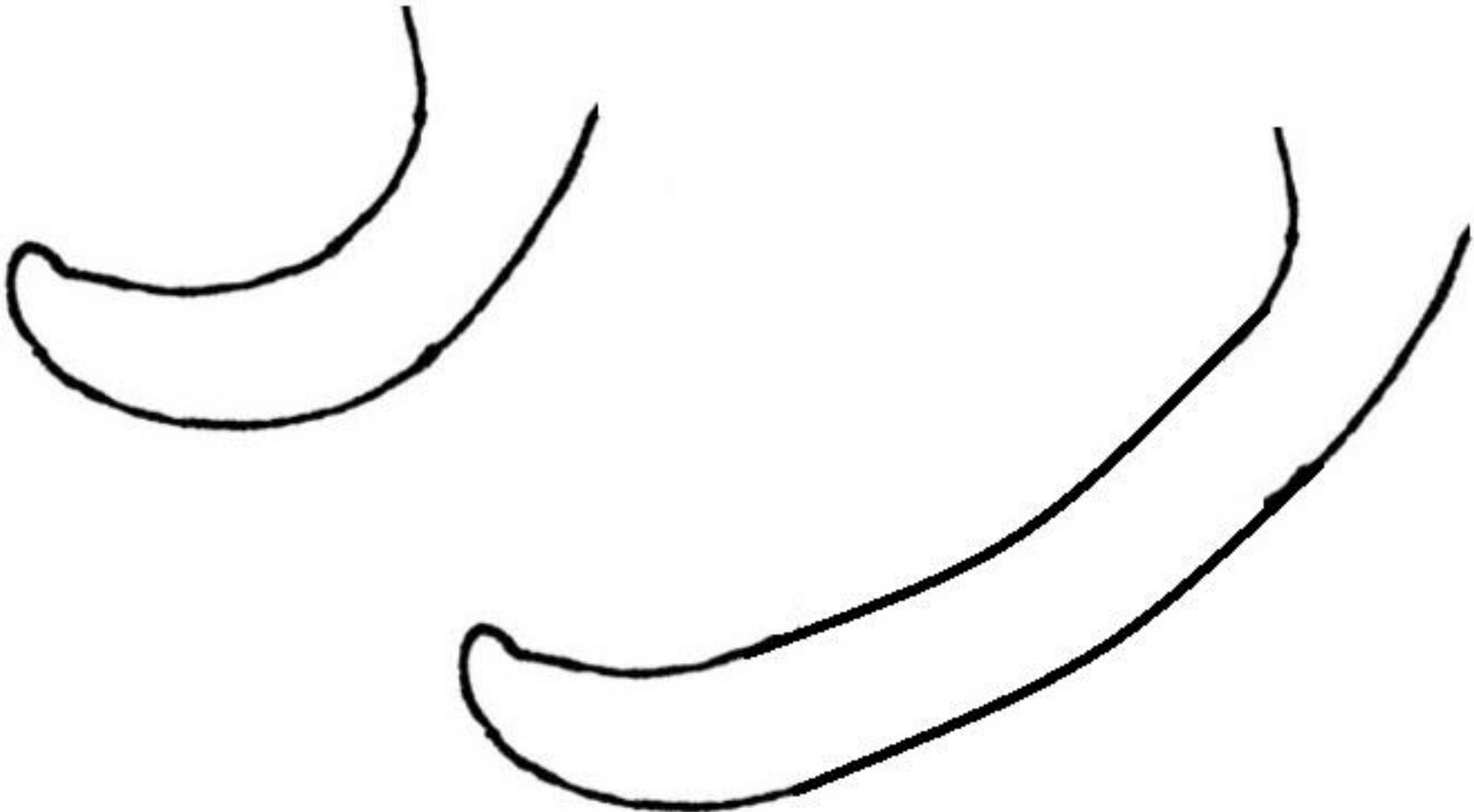


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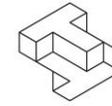
## Dinosaur Tail:

Everyone must choose either  
a long tail or a short tail.



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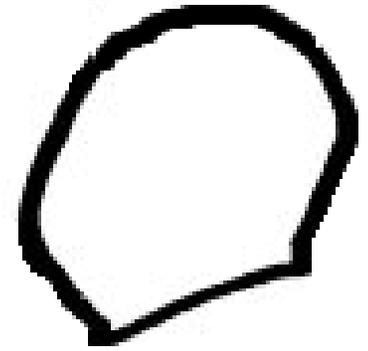
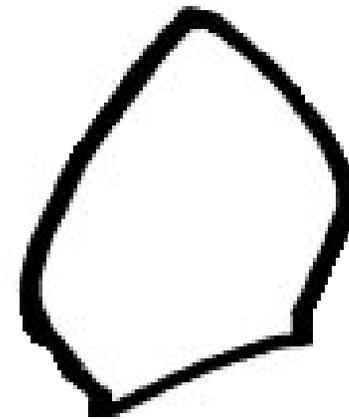
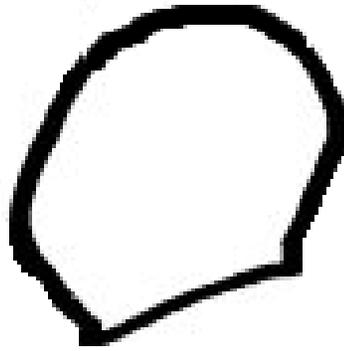
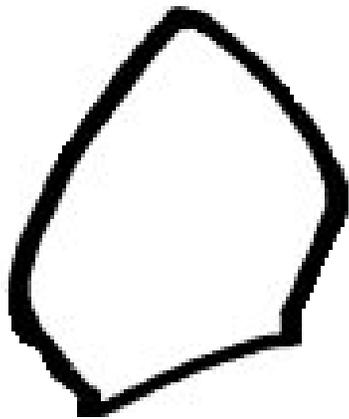
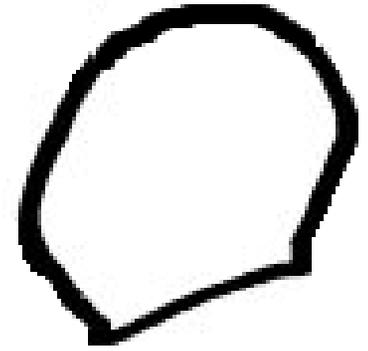
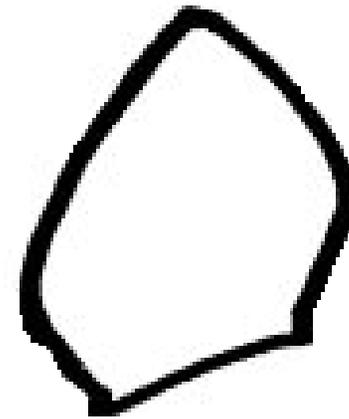
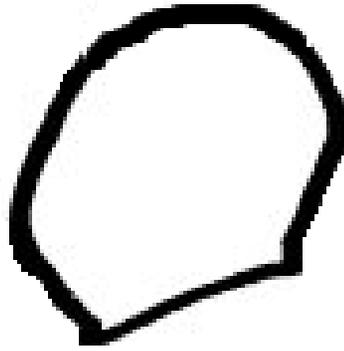


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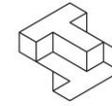
## Spikes:

Everyone must choose 4 spikes. All the spikes must be either pointed or rounded. Spikes must go along the back of the dinosaur.



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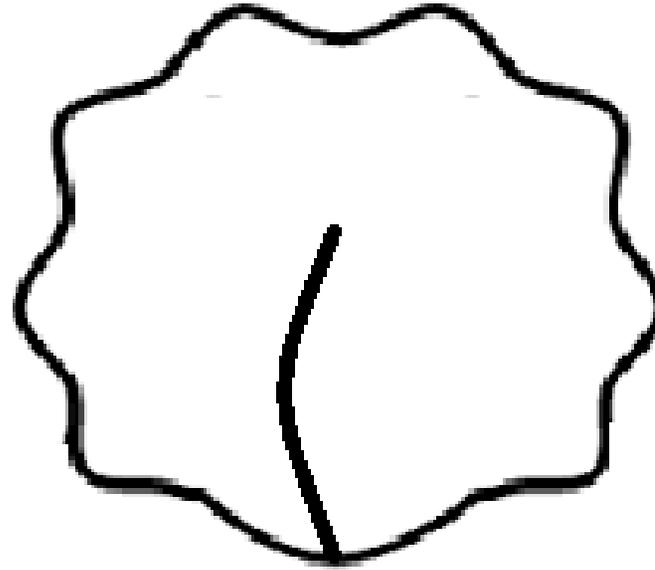


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## Head Sail:

If assigned a blue popsicle stick, you MUST include this piece on your dinosaur. DO NOT include if you are assigned a red popsicle stick.



## Nose Horn:

Creator's choice. If you want, you may include a spike on the nose of the dinosaur.

