

Natural Selection of the Carmel Origami Bird

Introduction:

The Carmel Origami Bird (*Avis papyrus*) lives on the Cool Creek Islands. It feeds on berries and drinks from natural springs. You might spot one if you're at the Flowing Well. Only those birds that can successfully fly the long distance between the sparsely spaced islands will be able to live long enough to breed. In this lab, you will breed several generations of Origami Birds and observe the effect the birds' form on the evolutionary success of these animals.

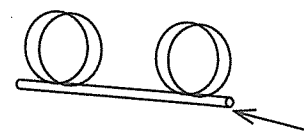
Materials:

Instructions tape die meter stick
 paper 3 straws coin

Procedure:

1. Make the ancestral bird (the original inhabitant) using these instructions:

- Cut two strips of paper, each strip 2 cm x 20 cm.
- Loop one strip of paper with a 1-cm overlap and tape.
- Repeat for the other strip of paper.
- Tape each strip 3 cm from each end of the straw.



(It should look something like this.)

2. Each bird lays three eggs in each generation. Breed offspring using these instructions:

- Number the straws 1-3. (Straw 1 is the ancestral bird made in step 1). Mark the head and tail of each straw.
- The first egg has no mutations. It is a clone of the parent. Use the ancestral for this chick to save time.
- The other two chicks have mutations. Determine the mutations by flipping your coin and throwing your die. Make your bird according to the information below. Record your birds' dimensions in the data table.

Coin Flip (determines where mutation occurs)	Die Throw (determines how the mutation affects the wings)
head = front wing mutation tail = back wing mutation	1 = wing position moves 1 cm toward the end of the straw 2 = wing position moves 1 cm toward the middle of the straw 3 = circumference (distance around the wing) increases 2 cm 4 = circumference (distance around the wing) decreases 2 cm 5 = width of wing increases 1 cm 6 = width of wing decreases 1 cm

- Test the birds. Release the birds with a gentle, overhand pitch. It is important to release the birds as uniformly as possible. Practice until you feel you can consistently get a good throw. Test each bird at least twice. Record your data in the data table on the next page. **Report your distances to the nearest cm.**
- The most successful bird is the one that can fly the farthest. It survives long enough to become the parent for the next generation. All other birds die. Circle the surviving bird in your data table.
- Repeat steps 2-5 for 3 more generations. The most successful bird becomes the parent of the next generation. The successful bird has 3 eggs: one without mutations (identical to the parent) and 2 with mutations (see step 2). Sometimes, mutations are lethal: the chick will not hatch. This will happen if a mutation causes a wing to fall off a straw, if the circumference of the wing is smaller than the circumference of the straw, or any other impossible combination. Fortunately, *Avis papyrus* is known to "double clutch" when an egg is lost. The bird lays another egg to replace the lost one. If you get a lethal mutation, disregard it and breed another chick

Dimensions of the Birds - Generation 1

	front wing to head (cm)	back wing to tail (cm)	circumference front wing (cm)	circumference back wing (cm)	width front wing (cm)	width back wing (cm)
Bird 1	3	3	19	19	2	2
Bird 2						
Bird 3						

Dimensions of the Birds - Generation 2

	front wing to head (cm)	back wing to tail (cm)	circumference front wing (cm)	circumference back wing (cm)	width front wing (cm)	width back wing (cm)
Bird 1						
Bird 2						
Bird 3						

Dimensions of the Birds - Generation 3

	front wing to head (cm)	back wing to tail (cm)	circumference front wing (cm)	circumference back wing (cm)	width front wing (cm)	width back wing (cm)
Bird 1						
Bird 2						
Bird 3						

Dimensions of the Birds - Generation 4

	front wing to head (cm)	back wing to tail (cm)	circumference front wing (cm)	circumference back wing (cm)	width front wing (cm)	width back wing (cm)
Bird 1						
Bird 2						
Bird 3						

Report distances and average to nearest cm.

Distance Birds Flew - Generation 1

	Trial 1 (cm)	Trial 2 (cm)	Average (cm)
Bird 1			
Bird 2			
Bird 3			

Distance Birds Flew - Generation 2

	Trial 1 (cm)	Trial 2 (cm)	Average (cm)
Bird 1			
Bird 2			
Bird 3			

Distance Birds Flew - Generation 3

	Trial 1 (cm)	Trial 2 (cm)	Average (cm)
Bird 1			
Bird 2			
Bird 3			

Distance Birds Flew - Generation 4

	Trial 1 (cm)	Trial 2 (cm)	Average (cm)
Bird 1			
Bird 2			
Bird 3			

Analysis Questions:

Name: _____

1. Make a line graph that shows the distance of the most successful bird for each generation.
 - a. Generation number on the x-axis and distance on the y-axis.
 - b. Include a title for your graph.
 - c. Include the units (in parentheses) for the y-axis.
 - d. Draw a line through the data points.



2. What were the dimensions of your most successful surviving bird (from 4th generation)?

Dimensions of Most Successful Bird - Generation 4

	front wing to head (cm)	back wing to tail (cm)	circumference front wing (cm)	circumference back wing (cm)	width front wing (cm)	width back wing (cm)
Bird _____						

Answer questions thoroughly in complete sentences.

3. Did this process result in better flying birds? _____ Explain the ways that this lab models natural selection.

4. If you kept repeating this process for thousands of generations, would it inevitably result in "the perfect design" for a "bird" made of paper, tape and a straw? _____ Explain.

5. Compare the specifications of your most successful bird with others in the class. Were all of the most successful birds identical? Describe differences. Why are they all not identical?

6. If each group continued this process for thousands of generations, predict how similar the birds would be to each other.

7. Evolution is the result of two processes: variation and selection. .
- a. How did your experiment produce variation among the offspring?

 - b. How did your experiment select offspring to breed the next generation?
9. In what way is this lab inaccurate in showing genetic variation? What are other sources of genetic variation?
8. Predict the appearance of your youngest bird's descendants under the following conditions.
- a. The selection conditions remain the same and the longest flying bird survives to produce the most offspring.

 - b. The selection conditions change and the worst flying bird survives to produce the most offspring.

