**Variation and Selection in the**

**Egyptian Origami Bird (*Avis papyrus)***

**INTRODUCTION**

The Egyptian Origami Bird (*Avis papyrus*) lives in arid regions of North Africa. It feeds on prom dates (*Palmus juniorseniorus*) and drinks from Palm Springs. Only those birds which can successfully fly the long distances between the sparsely spaced oases will be able to live long enough to breed successfully. In this lab, you will breed several generations of Origami Birds and observe the effect of various genotypes on the evolutionary success of these animals.

**MATERIALS**

Paper, tape, straws

Scissors

Coin

Six-sided die

**METHODS**

1. Prepare ancestral bird:
   1. Cut two strips of paper, each 5 cm long x 7 cm wide.
   2. Label one H to represent the Head (anterior) region and one T to represent the Tail (posterior) region of the bird
   3. Tape each strip of paper 2 cm from either edge of the straw.
   4. Refer to the image below to construct your bird



1. Breed offspring.
   1. Each Origami Bird lays a clutch of three eggs (1 clone & 2 chicks with mutations). Record the dimensions of each chick and hatch the birds using these instructions:
      1. The first egg has no mutations. It is a clone of the parent.
         * **In the interest of time you may substitute the parent when testing this chick.**
      2. The other two chicks have mutations. For each chick, flip your coin and throw your die then record the results on the table.
         * The coin flip determines where the mutation occurs: the head end or tail end of the bird.
         * The die throw determines how different mutations affect the wing.
         * Use the information in the table below to guide your bird construction.
      3. Lethal Mutations:
         * A mutation which results in a wing falling off of the straw, etc. is lethal. Fortunately, *Avis papyrus* birds are known to “double clutch” when an egg is lost. If you should get a lethal mutation, disregard it and breed another chick.

|  |  |
| --- | --- |
| Coin Flip  (determines *where* mutation occurs) | Die Throw  (determines *how* the mutation effects the wings) |
| Heads = Head (anterior) wing mutation  Tails = Tail (posterior) wing mutation | 1 = The wing moves 1 cm toward the end of the straw  2 = The wing moves 1 cm away from the end of the straw  3 = The length of the wing increases 1 cm  4 = The length of the wing decreases 1 cm  5 = The width of the wing increases 1 cm  6 = The width of the wing decreases 1 cm |

1. Test each chick.
   1. Choose 1 person in your group to ‘test’ your birds. This will reduce error involved in throwing motion.
   2. This person will, release the birds in a consistent manner from the same location with a gentle, overhand pitch.
   3. It is important to release the birds as uniformly as possible.
   4. Test each bird twice, record each flight distance and average the two distances for each chick.
2. Reproduction
   1. The most successful bird is the one which can fly the farthest.
   2. Mark which chick was the most successful on your table.
   3. The most successful bird is the sole parent of the next generation.
   4. Continue to breed, test, and record data for as many generations as you can in the time allotted.
3. Stop producing generations at least 10 minutes before the end of class and begin comparing offspring with other groups and answering questions.

**RESULTS**

Use the table to record the dimensions of all chicks, and the most successful bird in each generation.

**Origami Bird Data Sheet**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Generation** | **Parent/ Clone** | | | **2nd Chick** | | | **3rd Chick** | | | **Most Fit** |
|  | **Dimensions** | | **Flight (cm)** | **Dimensions** | | **Flight (cm)** | **Dimensions** | | **Flight (cm)** | **(Circle)** |
| P | Anterior wing dimensions | 5 cm x 7 cm | 1  2  Average | Anterior wing dimensions |  | 1  2  Average | Anterior wing dimensions |  | 1  2  Average | Clone  2nd Chick  3rd Chick |
| Posterior wing dimensions | 5 cm x 7 cm | Posterior wing dimensions |  | Posterior wing dimensions |  |
| Anterior wing to head | 2 cm | Anterior wing to head |  | Anterior wing to head |  |
| Posterior wing to tail | 2 cm | Posterior wing to tail |  | Posterior wing to tail |  |
| F1 | Anterior wing dimensions |  | 1  2  Average | Anterior wing dimensions |  | 1  2  Average | Anterior wing dimensions |  | 1  2  Average | Clone  2nd Chick  3rd Chick |
| Posterior wing dimensions |  | Posterior wing dimensions |  | Posterior wing dimensions |  |
| Anterior wing to head |  | Anterior wing to head |  | Anterior wing to head |  |
| Posterior wing to tail |  | Posterior wing to tail |  | Posterior wing to tail |  |
| F2 | Anterior wing dimensions |  | 1  2  Average | Anterior wing dimensions |  | 1  2  Average | Anterior wing dimensions |  | 1  2  Average | Clone  2nd Chick  3rd Chick |
| Posterior wing dimensions |  | Posterior wing dimensions |  | Posterior wing dimensions |  |
| Anterior wing to head |  | Anterior wing to head |  | Anterior wing to head |  |
| Posterior wing to tail |  | Posterior wing to tail |  | Posterior wing to tail |  |
| F3 | Anterior wing dimensions |  | 1  2  Average | Anterior wing dimensions |  | 1  2  Average | Anterior wing dimensions |  | 1  2  Average | Clone  2nd Chick  3rd Chick |
| Posterior wing dimensions |  | Posterior wing dimensions |  | Posterior wing dimensions |  |
| Anterior wing to head |  | Anterior wing to head |  | Anterior wing to head |  |
| Posterior wing to tail |  | Posterior wing to tail |  | Posterior wing to tail |  |
| **Generation** |  | **Parent/ Clone** |  |  | **2nd Chick** |  |  | **3rd Chick** |  | **Most Fit** |
|  | **Dimensions** |  | **Flight (cm)** | **Dimensions** |  | **Flight (cm)** | **Dimensions** |  | **Flight (cm)** |  |
| F4 | Anterior wing dimensions |  | 1  2  Average | Anterior wing dimensions |  | 1  2  Average | Anterior wing dimensions |  | 1  2  Average | Clone  2nd Chick  3rd Chick |
| Posterior wing dimensions |  | Posterior wing dimensions |  | Posterior wing dimensions |  |
| Anterior wing to head |  | Anterior wing to head |  | Anterior wing to head |  |
| Posterior wing to tail |  | Posterior wing to tail |  | Posterior wing to tail |  |

**Discussion Questions**

1. Did your experiment result in better flying birds? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Explain the ways that this activity models natural selection.

1. What are the dimensions of your most successful surviving bird?
2. Evolution is the result of two processes: variation and selection.
   1. How did your experiment produce variation among the offspring?
3. How did your experiment select offspring to breed the next generation?

4) Compare your youngest bird with your neighbor’s youngest bird.

a) Compare and contrast the wings of other birds with your own.

* 1. Explain why some aspects of the birds are similar.

c. Explain why some aspects of the birds are different.

5) Predict the appearance of your youngest bird’s descendants if:

a) the selection conditions remain the same, the longest flying bird survives and   
 reproduces.

b) the selection conditions change the worst flying bird survives to produce the most   
 offspring.

**Analysis**

Make a line graph that shows the distance of the most successful bird for each generation and include the following:

* Title for your graph.
* Axis labels of Generation Number on the x-axis and Distance with units (in parentheses) on the y-axis

