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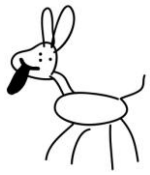
THE CHUCKABEES

Created by Charles A. Burrows



- **INTRODUCTION:** The chuckabees are imaginary animals that live on an imaginary continent. Although the chuckabees aren't real, they will experience situations that do really occur in the real world to real animals, and the resulting outcome will be very similar to what really happens in the real world... The chuckabees are going on an adventure! Will they ever be the same again?
- **MATERIALS:** one die (plural is dice), a cm ruler
- **LET'S GET WARMED UP: True or False**

T or **F**	1. Individuals are different from one another. (Identical twins are exceptions.)
T or **F**	2. Many of these differences are passed on from parents to their offspring.
T or **F**	3. In a population of animals, some individual animals may have characteristics that are advantages (speed, strength, etc.), and these individuals may have a better chance of surviving long enough to reproduce.
T or **F**	4. In a population of animals, some individual animals may have characteristics that are disadvantages (dark fur in snowy environment, long horns get caught in tree branches, etc.), and these individuals may have less of a chance of surviving long enough to reproduce.
T or **F**	5. If being short is an advantage, then the tallest animals in a population may not survive long enough to reproduce.
T or **F**	6. If many of the tallest members of a population of animals die before reproducing, then the majority of the offspring will be from the shorter animals.
T or **F**	7. In a population, if the majority of the offspring are from shorter animals, then the majority of the offspring will be shorter.
T or **F**	8. If cheetahs are able to kill the slowest of the gazelles, most of the gazelles remaining to reproduce will be fast.
T or **F**	9. If the only available food is high up in trees, the tallest animals or best climbers would most likely survive long enough to reproduce.
T or **F**	10. If the females prefer to mate with the males with the longest, most colorful tails, these are the males most likely to reproduce.
T or **F**	11. If another ice age occurs, animals with thicker fur will survive better and be more likely to survive long enough to reproduce.
T or **F**	12. If there are fast and slow animals in a herd and the slowest animals are killed, the average speed of the herd should increase.
T or **F**	13. If there are tall and short animals in a population and the tall ones die, the average height of the population should decrease.
T or **F**	14. Body length, leg length, tail length, neck length, ear length, and tongue length could each be an advantage or a disadvantage, affecting the chance of an animal to survive long enough to reproduce.

- **USEFUL VOCABULARY** – **Matching**: Write the number of the term next to its matching definition.

1. population	___	Changes in related organisms to the point where they are different enough to be considered separate species. This occurs when populations of one species are separated and adapt to their new environment or conditions (physiological, geographic, or behavioral).
2. reproductive isolation	___	Environmental forces such as scarcity of food or extreme temperatures that result in the survival of only certain organisms with characteristics that provide resistance.
3. selective pressures	___	Generally, a group of organisms living close to one another that interbreed with one another and do not breed with other similar groups.
4. speciation	___	Related individuals that resemble one another, are able to breed among themselves, but are not able to breed with members of another species.
5. species	___	Two populations or individuals of opposite sex are considered reproductively isolated from one another if they cannot together produce fertile offspring.

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➢ **PROCEDURE:**

A. What does a chuckabee look like? Roll the die one time for each characteristic listed in the table below. (Die is singular: two dice, one die) Enter the numbers in the table as they come up. This will be what one chuckabee looks like. **This may or may not be an average looking chuckabee...**

Individual Characteristics of One Chuckabee					
Body Length	Leg Length	Tail Length	Neck Length	Ear Length	Tongue Length

You will use these characteristics to draw an individual chuckabee later.

B. As a class, calculate the entire class average for each characteristic. Enter the results here, rounded to the nearest tenth.

AVERAGE = CHARACTERISTIC SUM ÷ TOTAL NUMBER OF INDIVIDUAL CHUCKABEES

Beginning Average Characteristics of Class/Starting Chuckabee Population					
Body Length	Leg Length	Tail Length	Neck Length	Ear Length	Tongue Length

You will use these characteristics to draw an original, average-looking chuckabee later.

Question: How does your individual chuckabee from **PROCEDURE A** compare to the average characteristics of the entire chuckabee population determined in **PROCEDURE B**?

C. Copy the numbers from the table in **PROCEDURE B** into the first row of your data table on **page 4**, "IN THE BEGINNING."

D. You will follow a segment of the original chuckabee population that is about to get **geographically separated** from the rest of the chuckabees. Roll the die to see how this geographic separation occurs for your group of chuckabees. Circle the number to the left of the explanation and underline the explanation:

1. Your group of chuckabees wanders over a huge **mountain** range looking for food.
2. Your group of chuckabees wanders into and over a huge **canyon** looking for food.
3. Your group of chuckabees is chased into and swims across a huge **river** by dangerous predators.
4. Your group of chuckabees is chased into and wanders across a huge **desert** by dangerous predators.
5. Your group of chuckabees is stranded on a huge section of a **rifting** (splitting apart) **continent**.
6. Your group of chuckabees is stranded on an **island** due to an isthmus (land bridge) once connecting it to the mainland being eroded away.

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E. Your group of chuckabees is now <u>completely separated</u> from the rest of the chuckabees. Over time, different environmental factors will affect your isolated population of chuckabees. At times, certain characteristics will be advantages. Other times these same characteristic may be disadvantages. Each row in your data table represents 100 years of passing time.

THE FOLLOWING THREE STEPS WILL BE REPEATED!

<u>STEP ONE</u> - FIRST ROLL: Roll the die to see which <u>one</u> characteristic is affected by **selective pressures** in the environment.

1st ROLL #	Chuckabee Characteristics
1	Body Length
2	Leg Length
3	Tail Length

1st ROLL #	Chuckabee Characteristics
4	Neck Length
5	Ear Length
6	Tongue Length

If you land on the number of a characteristic that has already reached **zero**, <u>roll again</u>.

<u>STEP TWO</u> - SECOND ROLL: Roll the die to see <u>how</u> this characteristic is affected due to **selective pressures.** Will it be an advantage or a disadvantage, and how much?

2nd ROLL #	Events	Math
1	Big advantage – most chuckabees with the shortest*** die	add **0.3**
2	Moderate advantage – many chuckabees with the shortest*** die	add **0.2**
3	Slight advantage – some chuckabees with the shortest*** die	add **0.1**
4	Slight disadvantage – some chuckabees with the longest*** die	subtract **0.1**
5	Moderate disadvantage – many chuckabees with the longest *** die	subtract **0.2**
6	Big disadvantage – most chuckabees with the longest *** die	subtract **0.3**
***shortest <u>body length</u> **or** <u>leg length</u> **or** <u>tail length</u> **or** <u>neck length</u> **or** <u>ear length</u> **or** <u>tongue length</u>		

<u>STEP THREE</u> - THIRD ROLL: Roll the die to determine <u>how long</u> this selective pressure will affect the population. This rolled number tells you how many times/rows to repeat the exact same calculation on the exact same characteristic. For example, rolling a five means that the calculation should be repeated a total of five times, for five rows, representing five hundred years of selective pressure.

Only apply the math to the characteristic that was selected in the first roll. Have the other five characteristics remain unchanged until their numbers are rolled. Instead of copying the same numbers repeatedly, downward, you can draw arrows to show that those characteristics remained unchanged.

- If the average body length reaches zero, your isolated population of chuckabees has gone **extinct**. Game over! You can't live without a body!
- If any <u>other</u> characteristic reaches zero, it is gone from the population forever! (Think about a snake's missing legs, or a chimp's missing tail…) Write zero in the table ONE TIME, then go back to STEP ONE. Nothing else should be written in this column for the remainder of the activity. Draw <u>arrows</u> in this column straight down to the end.

*****GO BACK AND REPEAT <u>STEP ONE – FIRST ROLL</u>*****

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	1	2	3	4	5	6
AMOUNT OF TIME THAT HAS PASSED	AVERAGE BODY LENGTH OF POP.	AVERAGE LEG LENGTH OF POPULATION	AVERAGE TAIL LENGTH OF POPULATION	AVERAGE NECK LENGTH OF POP.	AVERAGE EAR LENGTH OF POPULATION	AV. TONGUE LENGTH OF POP.
IN THE BEGINNING						
After 100 years						
After 200 years						
After 300 years						
After 400 years						
After 500 years						
After 600 years						
After 700 years						
After 800 years						
After 900 years						
After 1000 years						
After 1100 years						
After 1200 years						
After 1300 years						
After 1400 years						
After 1500 years						
After 1600 years						
After 1700 years						
After 1800 years						
After 1900 years						
After 2000 years						
After 2100 years						
After 2200 years						
After 2300 years						
After 2400 years						
After 2500 years						

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	1	2	3	4	5	6
AMOUNT OF TIME THAT HAS PASSED	AVERAGE BODY LENGTH OF POP.	AVERAGE LEG LENGTH OF POPULATION	AVERAGE TAIL LENGTH OF POPULATION	AVERAGE NECK LENGTH OF POP.	AVERAGE EAR LENGTH OF POPULATION	AV. TONGUE LENGTH OF POP.
After 2600 years						
After 2700 years						
After 2800 years						
After 2900 years						
After 3000 years						
After 3100 years						
After 3200 years						
After 3300 years						
After 3400 years						
After 3500 years						
After 3600 years						
After 3700 years						
After 3800 years						
After 3900 years						
After 4000 years						
After 4100 years						
After 4200 years						
After 4300 years						
After 4400 years						
After 4500 years						
After 4600 years						
After 4700 years						
After 4800 years						
After 4900 years						
After 5000 years						

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	1	2	3	4	5	6
AMOUNT OF TIME THAT HAS PASSED	AVERAGE BODY LENGTH OF POP.	AVERAGE LEG LENGTH OF POPULATION	AVERAGE TAIL LENGTH OF POPULATION	AVERAGE NECK LENGTH OF POP.	AVERAGE EAR LENGTH OF POPULATION	AV. TONGUE LENGTH OF POP.
After 5100 years						
After 5200 years						
After 5300 years						
After 5400 years						
After 5500 years						
After 5600 years						
After 5700 years						
After 5800 years						
After 5900 years						
After 6000 years						
After 6100 years						
After 6200 years						
After 6300 years						
After 6400 years						
After 6500 years						
After 6600 years						
After 6700 years						
After 6800 years						
After 6900 years						
After 7000 years						
After 7100 years						
After 7200 years						
After 7300 years						
After 7400 years						
After 7500 years						

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	1	2	3	4	5	6
AMOUNT OF TIME THAT HAS PASSED	AVERAGE BODY LENGTH OF POP.	AVERAGE LEG LENGTH OF POPULATION	AVERAGE TAIL LENGTH OF POPULATION	AVERAGE NECK LENGTH OF POP.	AVERAGE EAR LENGTH OF POPULATION	AV. TONGUE LENGTH OF POP.
After 7600 years						
After 7700 years						
After 7800 years						
After 7900 years						
After 8000 years						
After 8100 years						
After 8200 years						
After 8300 years						
After 8400 years						
After 8500 years						
After 8600 years						
After 8700 years						
After 8800 years						
After 8900 years						
After 9000 years						
After 9100 years						
After 9200 years						
After 9300 years						
After 9400 years						
After 9500 years						
After 9600 years						
After 9700 years						
After 9800 years						
After 9900 years						
STOP After 10000 years						

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- **Copy** your results into the three tables below. **Draw** the individual chuckabee and "average-looking chuckabees" next to the tables.*** If you need more space, use separate paper.

One Individual's Characteristics in the Beginning (may or may not be typical)	
Body Length	
Leg Length	
Tail Length	
Neck Length	
Ear Length	
Tongue Length	
(*use cm as units)**	

Beginning Average Characteristics of Class/Starting Population	
Body Length	
Leg Length	
Tail Length	
Neck Length	
Ear Length	
Tongue Length	
(*use cm as units)**	

Ending Average Characteristics of your Geographically Isolated Population (after _____ years)	
Body Length	
Leg Length	
Tail Length	
Neck Length	
Ear Length	
Tongue Length	
(*use cm as units)**	

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- **Enter** the final results from **<u>three other groups</u>** below. **Draw** *their* ending "average-looking chuckabees" next to the tables. If you need more space, use separate paper. **<u>Use cm as units.</u>**

Ending Average Characteristics of a **DIFFERENT** Geographically Isolated Population (after _____ years)	
Body Length	
Leg Length	
Tail Length	
Neck Length	
Ear Length	
Tongue Length	

Ending Average Characteristics of a **DIFFERENT** Geographically Isolated Population (after _____ years)	
Body Length	
Leg Length	
Tail Length	
Neck Length	
Ear Length	
Tongue Length	

Ending Average Characteristics of a **DIFFERENT** Geographically Isolated Population (after _____ years)	
Body Length	
Leg Length	
Tail Length	
Neck Length	
Ear Length	
Tongue Length	

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➢ CONCLUSION:

1. On separate paper, summarize, in a numbered list, what happened to your group of chuckabees from beginning to end.

2. Choose <u>three</u> of the following characteristics, and describe how each could be an advantage **<u>and</u>** a disadvantage in nature.

- ❖ Body Length
- ❖ Leg Length
- ❖ Tail Length
- ❖ Neck Length
- ❖ Ear Length
- ❖ Tongue Length

CHARACTERISTIC	HOW COULD IT BE AN ADVANTAGE IN NATURE?	HOW COULD IT BE A DISADVANTAGE IN NATURE?

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3. Did your "individual chuckabee" from Procedure A look the same as your "average-looking chuckabee" from the starting population in Procedure B? Explain.

4. How did your group of chuckabees get separated from the original chuckabee population?

5. Once your group of chuckabees became separated from the rest of the population, what characteristic (tail, legs, etc.) changed the most due to selective pressures?

6. Once your group of chuckabees became separated from the rest of the population, what characteristic (tail, legs, etc.) changed the least due to selective pressures?

7. Did your separated population go extinct? YES or NO

8. Did any characteristics (tail, legs, etc.) disappear from your separated population? If so, which one(s)?

9. As time passed, did your separated chuckabee population look more and more, or less and less like the original chuckabee population?

10. If enough time passes, is it possible that your separated population of chuckabees will look so different from the original population that you would not call them "chuckabees" anymore??? Explain.

11. If your separated population of chuckabees becomes very different from the other separated groups of chuckabees, is it possible that these different populations would no longer be able to create offspring with each other? Explain.

12. If two populations of animals become so different from each other that they cannot interbreed to produce fertile offspring anymore, would they still be the same species? Explain.

13. Look at how some other groups drew their chuckabees. Where there any noticeable differences BESIDES the six characteristics we focused on? Name four other characteristics that could change due to selective pressures in nature.

14. This process by which all forms of plant and animal life change slowly over time because of slight variations in the genes that one generation passes down to the next is called:

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TEACHER NOTES

- I strongly recommend that you **create your own conclusion questions** tailored to the level/course that you are teaching.

- Having the students work in pairs will speed the activity up.

- Can there ever be **no** selective pressures? It seems unlikely. Imagine a population of animals living on an island with plentiful food that's easy to get, with a nice comfortable year-round climate, and with no predators. There may still be diseases that kill off the least disease-resistant animals. There may be "sexual selection," where, for example, females prefer to mate only with males having specific characteristics (peacock's tail).

- In real life, there may be more than one selective pressure affecting an animal's characteristics at the same time. For instance, there may be cheetahs killing the slowest animals, and at the same time the only available food may be high up in the trees, so speed and height could both be affected at the same time.

- Speciation can occur without geographic separation (known as allopatric speciation). Other types of speciation are peripatric speciation, parapatric speciation, and sympatic speciation.

Alternative options:

- Let students choose the characteristics. It may be helpful to have them first pick the general type of life form: fish, plant, bird, etc. It will be easier if they choose characteristics that are numbers, like measurements such as length or number of digits or number of colors.
- Allow 2 or more characteristics to change simultaneously (for the overly ambitious).
- Students can continue the activity for longer than or less than 10,000 years.
- The focus of the activity could be on a body part, such as a "chuckabee hand," instead of an entire body.
- Use whole numbers (without decimals) for younger students. You may want to provide them with starting measurements, and make these measurements large enough to not reach zero too quickly.

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