

Africa Storyline - Part 1 Assessment Review

You recently determined parentage in a group of lions. Use the data below to answer the questions that follow.

Females	FCA26	FCA45	FCA77	FCA96
628	A/B	M/N	S/S	D/D
630	B/B	M/N	S/U	E/H
687	C/C	M/N	T/U	D/G
Males	FCA26	FCA45	FCA77	FCA96
633	B/C	N/O	S/T	D/E
631	A/A	M/O	S/S	F/H
695	B/C	N/O	T/T	D/F
668	B/C	M/O	S/U	D/D
657	C/C	M/M	S/T	H/G
Cubs	FCA26	FCA45	FCA77	FCA96
709	A/C	M/M	S/S	D/D
710	A/B	M/N	S/U	D/D
711	B/B	M/O	S/T	E/H
712	C/C	M/O	S/U	E/G
713	A/B	M/O	S/S	D/F

- Fill out the following table by placing **ONLY** the allele that must have come from the mother and father in each box. Be sure to write the ID numbers for the mother and father in the boxes in the left column.

Gene →	FCA26	FCA45	FCA77	FCA96
Cub 712	C/C	M/O	S/U	E/G
Mother # = <u>687</u>	C	M	U	G
Father # = <u>633</u>	C	O	S	E

- Why was it critical for you to use these four genes instead of just one? Please **provide specific evidence** from the data provided. **You need all four genes since many of the individuals share the same alleles. For example, males 633, 695, 668, and 657 all have C for gene FCA26. Multiple genes are needed to eliminate possible parents.**
- We discovered that Lulu (#630) was **NOT** the mother of all 5 cubs, even though she raised them. One example is cub #712. Based on the table, what **specific evidence** would you give that she **IS** related to this cub? **Lulu still shares many alleles with the other cubs, showing they are related. For example, she shares the M, S, and E allele with cub #712.**
- Based on your answer to #3, how does it help the lion population for females to raise any cub to which they are related? **By raising cubs that they are related to, the females get to pass on some of their alleles (the ones they share with the cubs, such as M, S, and E in the example from #3), which is beneficial since the females get to pass on some of their genetics if the cubs survive to adulthood.**

5. Using the data in the table above, **draw a picture of the chromosomes with labeled alleles** of the mother, father, and cub 712 for **gene FCA77**.

Mother	Father	Cub 712
Mom's single chromosome should have an U labeled on it	Father's single chromosome should have a S labeled on it.	Cub should have 2 chromosomes, one labeled with a U (from mom) and one labeled with an S (from dad. You get ONE chromosome from mom, and ONE chromosome from dad.

6. Explain how you know which chromosome was donated to the cub from each parent for question #5. Using the table on page 1, you know that the mom gave the cub a U allele at gene FCA77 and that dad gave the cub a S allele at FCA77

Use the data table provided to answer #7-9.

	Mass of prey item	Total energy cost to hunt & kill (kcal)	Total energy available per kill (kcal)
 Meerkat	0.77 kg	-3,000	+1,000
 Warthog	60 kg	-5,000	+12,000
 Wildebeest	265 kg	-10,000	+25,000
 Zebra	310 kg	-55,000	+170,000

7. Gorongosa National Park in Mozambique once had large populations of zebras. In 1977, a civil war broke out within the country and lasted for 15 years. Zebra populations were wiped out completely due to fighting. Predict how this would impact the size of lion prides in Gorongosa National Park. Less zebras would lead to less lions over time since there would be less prey species available. This would increase competition between lion prides for wildebeest, warthogs, and other prey species. Lion prides would likely decrease in size.
8. Support your prediction (from #7) by citing **specific evidence** from the data and/or calculations above. Zebras offer the largest amount of energy per kill when compared to the amount of energy it takes to hunt a zebra. Warthogs only offer a net gain of 7,000kcal (12,000-5,000), wildebeest only offer a net gain of 15,000kcal (25,000-10,000), and meerkats are not with hunting since they create a loss of energy of 2,000kcal (1,000-3,000). If zebras are wiped out, there will be less prey species that are energy rich available for the lions.
9. Explain how the evidence (from #8) supports your claim. If lions hunt in groups, zebras offer the best option for obtaining energy for the pride. If zebra numbers go down, lions will have to rely on other, less energy rich species for food. If there is less energy (less prey species) available in the ecosystem, lion numbers will decrease. Therefore lion prides will decrease in size.

10. What indicator(s) would give you a clue that an organism(s) hunts in a group?
- Organisms take down prey that is much larger than themselves
 - Prey species have more energy available than a single individual needs
 - Organisms are not great at hunting solo/don't have high success on their own
11. What indicator(s) would give you a cue that an organism hunts solo?
- Organisms catch prey that is smaller than themselves or smaller in size.
 - Prey species have very little energy, so multiple prey need to be consumed to meet energy requirements
 - Organisms are successful at hunting solo/have a high success rate on their own

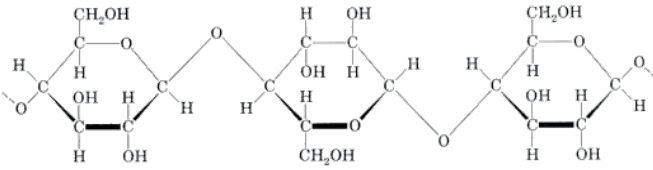
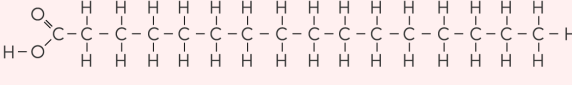
Use the [microsatellite data](#) to assist in answer #12-13.

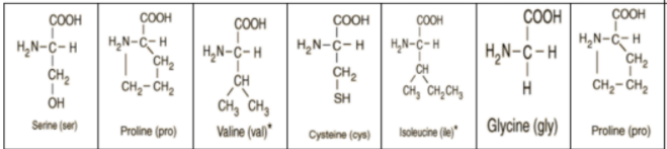
12. As we studied Lulu and her cubs, we read about the migration of lions between multiple prides (Goals, Rietfontein, and Homob). How does the microsatellite data provide further evidence that lions migrate between populations? Compare **TWO** prides and **cite specific evidence** in your answer.

Microsatellite data gives evidence that lions migrate between populations due to the shared colors that can be seen between lion prides that live somewhat close geographically. For example, Botswana and Zimbabwe both share blue colors in the individuals and also live fairly close to each other. This shows that these prides likely share genetic similarities due to individuals migrating and mating between the populations. Botswana also has many individuals that have yellow color, showing that they likely share alleles with the Umfolozi prides; this gives evidence that some individuals may have migrated or mated between these two prides.

13. Several lions from the Etosha pride migrated and joined the Botswana pride. Over time, the newly migrated Etosha lions mated with existing Botswana lions. What specific changes would you expect in the microsatellite data of Botswana as a result of this mating? **Reference changes in color and/or frequency.* Since Etosha lions are almost all entirely green, you would expect more green color to appear in the Botswana population over time if Etosha lions started mating with individuals from Botswana. The green color would increase in frequency among individuals in the Botswana pride.

Use the pictures of various macromolecules below to answer the questions.

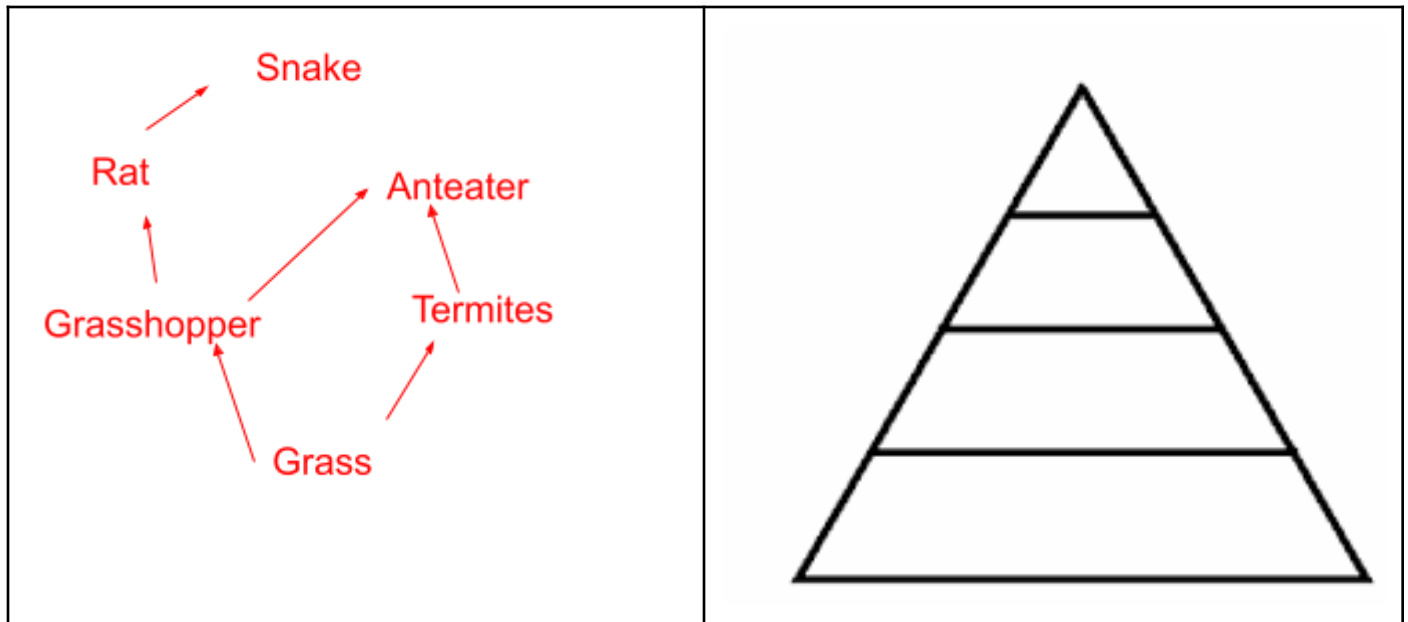
	14. What type of macromolecule is shown? Carbohydrate 15. What elements are present in this molecule? C, H, O 16. Give an example of an organism that uses primarily this type of molecule for energy. Herbivore (elephant)
Saturated fatty acid 	17. What type of macromolecule is shown? Lipid/fatty acid 18. What elements are present in this molecule? C, H, O

	19. Give an example of an organism that uses primarily this type of molecule for energy. Carnivore (lion)
	20. What type of macromolecule is shown? Protein 21. What elements are present in this molecule? C, H, O, N 22. What is represented in one box? How many of “these” are there in the entire molecule? Amino acids are represented by each box. There are 7 amino acids in this molecule. 23. What is this macromolecule most commonly used for in organisms? Building and repairing tissues.

Using the information provided in the data table complete each of the following:

- Create a food web in the box on the left using data from the table
- Fill in the trophic level & feeding niche for each organism in the data table.
- Create a trophic pyramid that includes all of the organisms provided.

Organism	Trophic Level	Prey/Food	Feeding Niche
Grass	Producer (Trophic level 1)	X	X
Termites	Primary Consumer (TL 2)	Grass	Herbivore
Grasshopper	Primary Consumer (TL 2)	Grass	Herbivore
Anteater	Secondary Consumer (TL 3)	Termites/Grasshopper	Carnivore
Rat	Secondary Consumer (TL 3)	Grasshopper	Carnivore
Snake	Tertiary Consumer (TL 4)	Rat	Carnivore



****Bottom of the pyramid should have GRASS, the second level should have TERMITES & GRASSHOPPER, the third level should have ANTEATER & RAT, and the fourth level should have SNAKE.**

Using your food web and/or trophic pyramid, answer #22-25.

22. If the grass has 25,000 kcal of energy, how much energy would be available for the rat and anteater? **There would be 250 kcal of energy available for the anteater and the rat. This can be found by taking $25,000 \times 0.1 = 2,500$ which is using the rule of 10% to see how much energy is passed on to the grasshoppers & termites from the grass. THEN you need to take $2,500 \times 0.1 = 250$ kcal to solve how much energy is available to the anteater and the rat. This again used the rule of 10%.**
23. Explain what happens to population size as the trophic level increases. WHY?
The population size decreases at each trophic level because there is LESS energy available at each trophic level. This is why there are LESS carnivores than there are herbivores and there are LESS herbivores than there are producers (plants). The 10% rule tells us that only 10% of the energy from one trophic level is available to the trophic level above it. For example, only 10% of the energy available in a zebra will move onto the lion that eats it.
24. What is the ultimate source of energy for the ecosystem? **The sun (for *most* ecosystems)**
25. What process is powered by the answer to #24? What type of organism performs this process?
Photosynthesis is powered by the sun and is performed by plants (producers).

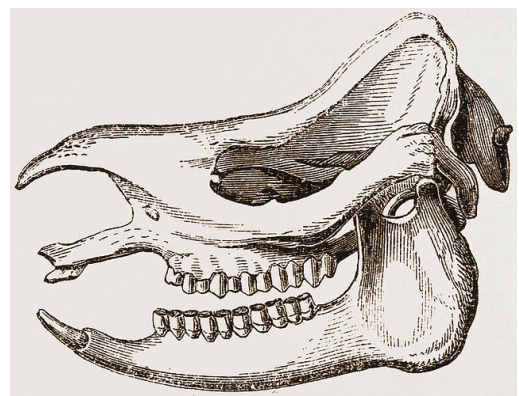
Write a CER to answer the Driving Question.

Driving Question: What feeding niche does the following organism occupy?

Claim: **This organism is an herbivore.**

Evidence:

- Organism has no canines
- Organism has many molars



- Organism has a lumpy/bumpy large intestines
- Organism has a cecum
- Organism has a long large intestines

Reasoning:

This organism has many molars to grind up plant matter that it consumes. It has no need for canines since it does not rip or tear meat. This organism has a long large intestine with a cecum since it takes longer to digest plant materials compared to meat due to the number of bonds in cellulose. Due to the traits this organism possesses, we can infer that it is an herbivore.

