AP biology information packet 20-21

I am glad you have signed up for AP biology!!! I am sure you may have some questions about how the course will work, so I will attempt to address a few of them. Please feel free to contact me at home (258-9187) or by email (kjasper@lexingtonchristian.org) if you or your parents have further questions.

What books do I need?

1. Your textbook is **Biology, 13th edition AP edition** by Sylvia Mader. This is a fairly new college text (just changed for 19-20). The ISBN number is on the textbook guide provided by the office. You **will need this text for the summer assignments**

2. An important supplement to this text is the **Barron's 7th edition AP biology exam** book. We use this throughout the second half of the year, so it needs to be purchased by the first day of second semester.

What is the focus of AP biology?
This class is like taking a first year college biology majors class!
This course takes the concepts learned in general or Honors biology and covers them in a significant amount of detail. We will also attempt to link processes and systems to give you a big-picture understanding of the living world and the understanding of how to apply your knowledge. For example, you probably learned in your introductory biology course that there are light dependent and light independent reactions in photosynthesis. In AP biology, we will review these processes in depth, then do labs or reading that help us apply that knowledge and fully understand what it means to living things.

We will spend about 20% of the class in laboratory activities. This is only possible if some of the basic content work is done out of class. Since this is a second year course for you, it is expected that some of the material will be a review, allowing us to move quickly to applying the information in lab context.

What are the summer assignments?
OK, so you maybe were NOT asking that question. Anyway, to get us started, here are a few things you need to do over the summer. All are due THE FIRST MONDAY OF SCHOOL, Monday, August 17th. I will be chaperoning the senior retreat, so juniors will have Thursday and Friday in class to work on these. I don't know if you can finish all of them in that time, but you can do at least half in those two class days. Seniors will want to work on them ahead of time.

Also, if you have never had an AP class or haven't taken/didn't do well in Honors Biology, it would be wise to do the assignments early to see if you feel the class is a good fit for you. If these assignments are really difficult, the class is going to really push you. Maybe that's ok for you right now and maybe another class is a better fit.

SUMMER ASSIGNMENTS LIST

TOPIC ONE: GRAPHING SKILLS

1. Complete the video and packet to review graphing.

TEXTBOOK: CHAPTER ONE

2. Read chapter 1 in the textbook. When you finish, complete the questions in the ASSESSING THE BIG IDEAS #1-11 and the APPLYING SCIENCE PRACTICES #1-3 on page 17
3. To go along with that chapter, read the article "Call duration as an indicator of genetic quality in male gray tree frogs" and answer the questions.

TEXBOOK: CHAPTER TWO

4. Read chapter 2 on Basic Chemistry. When you finish, read the article on acid deposition and do questions 1-3 on page 32. Then do the ASSESSING THE BIG IDEAS #1-8 on page 34 and APPLYING THE SCIENCE PRACTICES 1-3 on page 35

5. Complete the learning styles survey here:
https://www.how-to-study.com/learning-style-assessment/

and score it. You will be sent a link before the start of school to put this information into a google doc.

We will have a summer work quiz on chp 1, a few parts of chp 2 and graphing on Wednesday, August 19th.

Because this class involves a great deal of independent study, data analysis and reading, these take home assignments will be a good introduction to how the course will work. Most of the info covered in the first two chapters is review, so this will be a good opportunity test out the class with material you are familiar with already.

I am looking forward to working with you this coming year. This class is a difficult challenge for both teacher and student, but we will have fun along the way. I have been praying this verse over the class as we embark on this exciting journey of learning more about the Lord through HIS creation. "Let the favor of the Lord our God be on us; establish for us the work of our hands – establish the work of our hands!" Psalm 90:17.

Blessings,

Kenna Jasper

Kenna Jasper

AP BIO GRAPHING AND DATA ANALYSIS PRACTICE

Watch this first! Graphing https://www.youtube.com/watch?v=9BkbYeTC6Mo

1. Line graphs – Show change over ____________ and Scatter plots show correlation of ____________

FOR BOTH OF LINE GRAPHS AND SCATTER PLOTS

X axis is for the ________________variable

Y axis is for the _______________ variable

3. Bar graph Comparing ______________

4. Histogram - Distribution of ___________

5. Pie Chart Parts of a ____________

6. List 5 elements that all graphs should display

Read the following article

https://www.biologyforlife.com/interpreting-error-bars.html

After watching the video and reading the article, answer the following practice AP Biology questions. You should answer in COMPLETE SENTENCES and label each part of the question (a, b, etc)

BIOLOGY

Section II

8 Questions

Total Time—90 minutes

Reading Period—10 minutes

Writing Period—80 minutes

Directions: Questions 1 and 2 are long free-response questions that require about 22 minutes each to answer and are worth 10 points each. Questions 3–8 are short free-response questions that require about 6 minutes each to answer. Questions 3–5 are worth 4 points each and questions 6–8 are worth 3 points each.

Read each question carefully and completely. You are advised to spend the 10-minute reading period planning your answers. You may begin writing your responses before the reading period is over. Write your response in the space provided for each question. Only material written in the space provided will be scored. Answers must be written out in paragraph form. Outlines, bulleted lists, or diagrams alone are not acceptable.

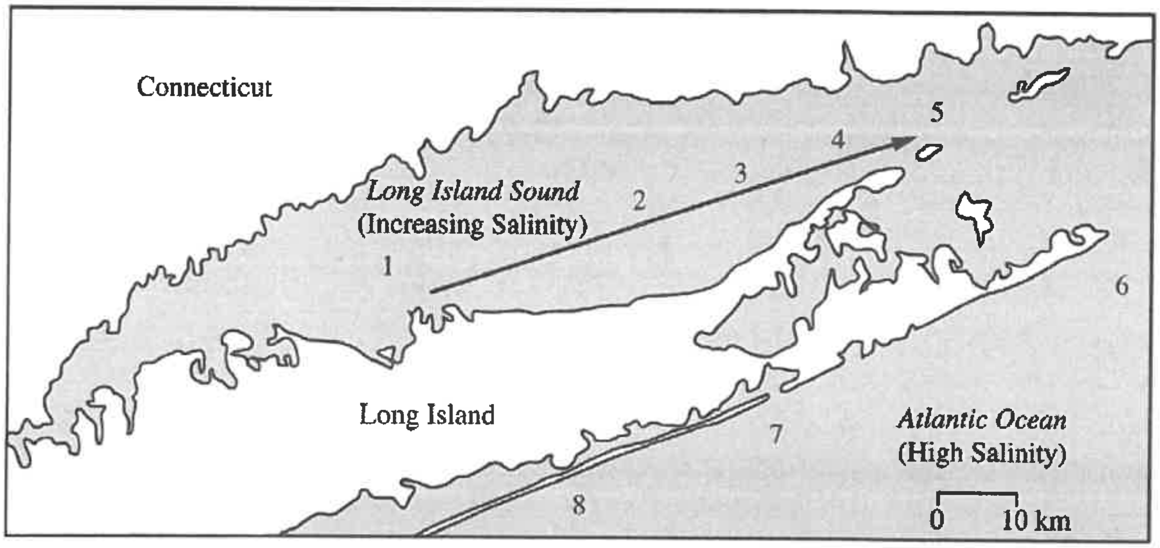


Figure 1. Sampling sites of marine mussels at various locations (1–8) in Long Island Sound and the Atlantic Ocean

TABLE 1. PERCENT OF INDIVIDUALS POSSESSING *lap*^{94} ALLELE

	Long Island Sound					Atlantic Ocean		
Site	1	2	3	4	5	6	7	8
lap^{94} frequency (%)	13	16	25	37	55	59	59	59
Salinity	Low ⟶				High	High		

1. Leucine aminopeptidases (LAPs) are found in all living organisms and have been associated with the response of the marine mussel, *Mytilus edulis*, to changes in salinity. LAPs are enzymes that remove N-terminal amino acids from proteins and release the free amino acids into the cytosol. To investigate the evolution of LAPs in wild populations of *M. edulis*, researchers sampled adult mussels from several different locations along a part of the northeast coast of the United States, as shown in Figure 1. The researchers then determined the percent of individuals possessing a particular *lap* allele, lap^{94}, in mussels from each sample site (table 1).

   (a) On the axes provided, **construct** an appropriately labeled bar graph to illustrate the observed frequencies of the lap^{94} allele in the study populations.

   (b) Based on the data, **describe** the most likely effect of salinity on the frequency of the lap^{94} allele in the marine mussel populations in Long Island Sound. **Predict** the likely lap^{94} allele frequency at a sampling site between site 1 and site 2 in Long Island Sound.

   (c) ~~**Describe** the most likely effect of LAP^{94} activity on the osmolarity of the cytosol. **Describe** the function of LAP^{94} in maintaining water balance in the mussels living in the Atlantic Ocean.~~

   (d) ~~Marine mussel larvae are evenly dispersed throughout the study area by water movement. As larvae mature, they attach to the rocks in the water. **Explain** the differences in lap^{94} allele frequency among adult mussel populations at the sample sites despite the dispersal of larvae throughout the entire study area. **Predict** the likely effect on distribution of mussels in Long Island Sound if the lap^{94} allele was found in all of the mussels in the population. **Justify** your prediction.~~

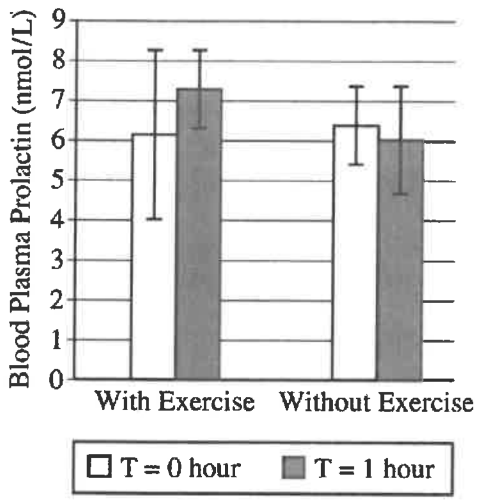


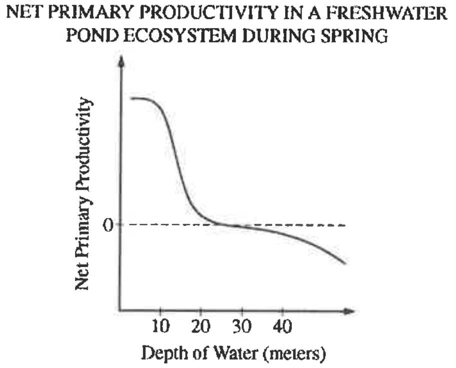
Figure 1. Effect of exercise on blood prolactin levels in adult males. The data represent the means ± $2SE_{\bar{X}}$.

8. Researchers conducted a study to investigate the effect of exercise on the release of prolactin into the blood. The researchers measured the concentration of prolactin in the blood of eight adult males before (T = 0 hour) and after one hour (T = 1 hour) of vigorous exercise. As a control, the researchers measured the concentration of blood prolactin in the same group of individuals at the same times of day one week later, but without having them exercise. The results are shown in Figure 1.

   (a) **Justify** the use of the without-exercise treatment as the control in the study design.

   (b) Using evidence from the specific treatments, **determine** whether prolactin release changes after exercise. **Justify** your answer.

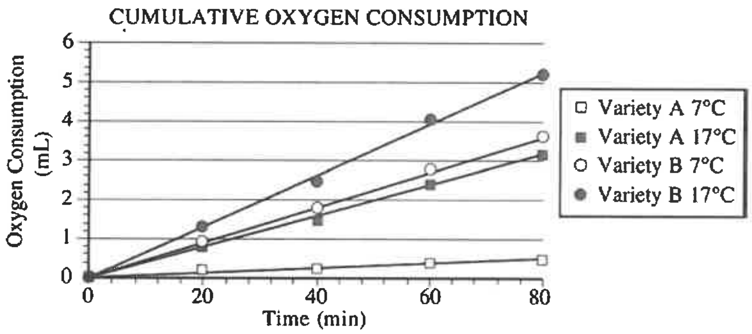
3. Primary productivity is a measure of oxygen production as a result of PHOTOSYNTHESIS in plant life. In an aquatic ecosystem, the following data was collected.



Describe the trend in the data: (as ______-increases, _________decreases or something of the sort)

At Greater than 30 m depth, DESCRIBE what occurs and PREDICT why this would occur. JUSTIFY your prediction.

4. An agricultural biologist was evaluating two newly developed varieties of wheat as potential crops. In an experiment, seedlings were germinated on moist paper towels at 20ºC for 48 hours. Oxygen consumption of the two-day-old seedlings was measured at different temperatures. The data are shown in the graph below.



(a) **Calculate** the rates of oxygen consumption in mL/min for each variety of wheat at 7°C and at 17°C. **Show** your work (including your setup and calculation).

(b) **Explain** the relationship between metabolism and oxygen consumption. **Discuss** the effect of temperature on metabolism for each variety of seedlings the decrease in resistance because of an increase of current in the path with the higher current.

The induction of a conducting path in the absence of light is clearly triggered by the presence of the first path, because at constant temperature V_{ind} decreases with higher current flow through the conducting path and with closer proximity to the first path. The distance across which a metallic path can be induced can be much greater than the distance at which a change of reflectivity due to the formation of metallic patches can be detected. The trigger voltage is distinctly dependent on temperature, whereas the width of a conducting path is not.

The successful visualization of the local photoinduced I-M transition by the depicted differential reflection technique opens the way for a variety of further experimental studies. Our observations already indicate that the requirements for creating the transition and maintaining the transition are fundamentally different. With respect to applications, the local I-M transition is a tool for switching the resistivity of a material by many orders of magnitude in a controllable and observable way. The generation and removal of one or more conducting paths at arbitrarily chosen spots of a sample is performed by the appropriate choice of external parameters and monitored with visible light. These features suggest an application of the local photoinduced I-M transition in the construction of optical switching devices. In the experiment, a gap of 150 μm between the electrodes was chosen to simplify the imaging, and a regulated dc power supply was used for experimental convenience. With a gap width of 25 μm, however, the applied voltage could be reduced to the order of 1 V, which can be provided by ordinary power supplies.

REFERENCES AND NOTES

1. A. J. Millis, *Nature* **392**, 147 (1998).
2. Z. Jirak, S. Krupicka, Z. Simsa, M. Dlouha, S. Vratislav, *J. Magn. Magn. Mater.* **53**, 153 (1985).
3. Y. Tomioka, A. Asamitsu, H. Kuwahara, Y. Morimoto, Y. Tokura, *Phys. Rev. B* **53**, R1689 (1996).
4. H. Yoshisawa, H. Kawano, Y. Tokura, *ibid.* **52**, 13145 (1995).
5. A. Asamitsu, Y. Tomioka, H. Kuwahara, Y. Tokura, *Nature* **388**, 50 (1997).
6. Y. Morimoto, H. Kuwahara, Y. Tomioka, Y. Tokura, *Phys. Rev. B* **55**, 7549 (1997).
7. V. Kiryukhin *et al.*, *Nature* **386**, 813 (1997).
8. K. Miyano, T. Tanaka, Y. Tomioka, Y. Tokura, *Phys. Rev. Lett.* **78**, 4257 (1997).
9. W. Eberle *et al.*, *Appl. Phys. Lett.* **68**, 3329 (1996).
10. W. Prettl, in *Nonlinear Physics of Complex Systems. Current Status and Future Trends*, J. Parisi, S. C. Muller, W. Zimmermann, Eds. (Springer-Verlag, Berlin, 1996), pp. 341–352.
11. N. Balkan, B. K. Ridley, A. J. Vickers, Eds., *Negative Differential Resistance and Instabilities in 2D Semiconductors*, NATO Advanced Research Workshop, Il Ciocco, Lucca, Italy (NATO ASI Series, Overijse, Netherlands, 1992).
12. Y. Tomioka, A. Asamitsu, Y. Morimoto, Y. Tokura, *J. Phys. Soc. Jpn.* **64**, 3626 (1995).
13. T. Mori *et al.*, *ibid.* **66**, 3570 (1997).
14. K. Ogawa, W. Wei, K. Miyano, Y. Tomioka, Y. Tokura, *Phys. Rev. B*, in press.
15. Y. Okimoto, Y. Tomioka, Y. Onose, Y. Otsuka, Y. Tokura, *Phys. Rev. B*, in press.
16. Supported in part by the Core Research for Evolutional Science and Technology (CREST) of JST, and by a Grant-in-Aid for Center of Excellence Research from the Ministry of Education, Science, Sports and Culture of Japan. The work at JRCAT was supported by The New Energy and Industrial Technology Development Organization.

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Call Duration as an Indicator of Genetic Quality in Male Gray Tree Frogs

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The "good genes" hypothesis predicts that mating preferences enable females to select mates of superior genetic quality. The genetic consequences of the preference shown by female gray tree frogs for long-duration calls were evaluated by comparing the performance of maternal half-siblings sired by males with different call durations. Offspring of male gray tree frogs that produced long calls showed better performance during larval and juvenile stages than did offspring of males that produced short calls. These data suggest that call duration can function as a reliable indicator of heritable genetic quality.

The "good genes" model of sexual selection predicts that some attributes of male courtship displays advertise genetic quality. Preferences for such attributes should allow females to mate with high-quality males and thereby benefit indirectly through enhanced quality of offspring (*1*). Although the good genes hypothesis has been tested several times (*2*), few studies have provided direct genetic evidence supporting this hypothesis (*3*). Only one such study involved a species in which females cannot benefit directly from their choice of mates (*4*). Because selection for direct benefits such as courtship feeding or parental care should overwhelm any selection for indirect (genetic) benefits (*5*), the role of good genes selection in the evolution and maintenance of female preferences is best tested in species in which females do not benefit directly from mate choice.

Female gray tree frogs (*Hyla versicolor*) strongly prefer male advertisement calls of long duration in laboratory experiments (*6*, *7*). In the field, females freely initiate matings with calling males and do not always choose the first male encountered (*7*). Because males do not defend oviposition sites, offer nuptial gifts, or contribute parental care (*8*, *9*), and no difference has been found in fertilization success as a function of call duration (*10*), there are no apparent direct benefits of a female's mate choice. We therefore predicted that females selecting mates with long calls should benefit indirectly through increased fitness of offspring. This prediction can be tested by evaluating the relation between paternal call duration and the genetic quality of offspring.

Male gray tree frog advertisement calls consist of rapidly repeated pulses. In dense choruses and in response to playbacks, males tend to increase call duration by increasing the number of pulses per call (*11*, *12*). Nonetheless, some males consistently produce longer calls than others in the same acoustic environment (*7*, *12*–*14*). Although long calls are usually produced at slow rates, thereby keeping aerobic metabolic costs relatively constant (*11*, *14*), males that produce long calls spend less time calling per night (*11*) and attend fewer choruses per season (*8*) than males that produce short calls. Long calls thus appear to impose higher nonaerobic costs than short calls. Call duration may, therefore, be an honest indicator of male genetic quality.

We tested whether call duration indicates heritable genetic quality by using maternal half-siblingships (half-sibships) to compare the performance of different males' offspring while experimentally controlling for all maternal effects. Maternal half-sibships were generated by artificially crossing each female with two males that had been giving calls of distinctly different durations in the same social environment (Table 1). Thus, within each maternal half-sibship, one sibship was sired by a male with calls of longer duration than the male siring the other sibship. Because call duration varies with chorus density, males' calls must be assessed in the same social context in order to be validly compared. Thus, in 1995 we selected nine sets of two males that had

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been calling within 2 m of each other, and in 1996 we selected six sets of two field-caught males that had been calling simultaneously in a small captive chorus. The mean difference in call duration between the long- and the short-caller in each set was 10.1 pulses per call in 1995 and 15.8 pulses per call in 1996 (Table 1); in laboratory experiments, female *H. versicolor* routinely base preferences on differences of as few as 2 pulses per call (*15*). Furthermore, the average call durations of individual males classified as long-callers did not overlap with the average call durations of individuals classified as short-callers (*16*). Long- and short-callers did not differ in body mass. External artificial fertilization allowed unambiguous assignment of paternity, and rotation of the egg-stripping of each female between the pair of males eliminated the possibility of effects of fertilization order (*17*). In 1995, each of nine gravid females was artificially crossed with a different set of males to generate nine maternal half-sibships. In 1996, each of 11 gravid females was artificially crossed with at least one set of males to generate 16 maternal half-sibships. All frogs were collected near a pond in Boone County, Missouri.

Because the relative performance of different genotypes can vary significantly with environmental conditions (*18*), we reared the resulting tadpoles at two food levels, thereby creating an unfavorable and a favorable growth environment in which to compare the performance of offspring (*19*). Comparison of our results with those from field studies indicates that our high food treatment was a realistic approximation of conditions encountered in nature (*20*). Tadpoles from the crosses (1995, $n = 538$; 1996, $n = 384$) were raised individually in containers filled with 1.0 liter of water in the laboratory at the two food levels; 15 tadpoles per family were reared at each food level in 1995 and six tadpoles per family in 1996 (*21*). To assess offspring performance, we used several variables (*22*) that are important determinants of fitness in anurans, predicting future survival and age and size at maturity, which influence lifetime reproductive success (*23*).

Offspring of males with long calls always performed significantly better than or not significantly differently from offspring of males with short calls (*24*) (Table 2). In multivariate analyses where responses were combined to account for correlations among response variables (*25*), the main effect of call duration was significant at both food levels in 1996 and showed the same trend at both food levels in 1995 (Table 2), with offspring of males with long calls showing a general performance advantage over offspring of males with short calls. The probability of obtaining these four multivariate results that independently support the same directional hypothesis was calculated as $P = 0.0008$ (Table 2) with the use of a combined probability test (*26*). The multivariate tests therefore support the hypothesis that offspring performance is predicted by paternal call duration.

Table 1. Average calling performance of sires exhibiting long versus short calls. For each 1995 male, approximately 25 consecutive calls were analyzed from field recordings. For each 1996 male, at least 20 min of consecutive calls were analyzed from digitally collected data.

Year	Performance	Call duration		Calling effort*
		Pulses per call	Seconds	
1995	Long-callers	28.3	1.74	0.214
	Short-callers	18.2	1.05	0.188
	Difference	10.1 ± 4.9†	0.69 ± 0.36†	0.026 ± 0.040‡
1996	Long-callers	31.5	1.41	0.092
	Short-callers	15.7	0.68	0.082
	Difference	15.8 ± 4.6†	0.72 ± 0.24†	0.010 ± 0.048‡

*Calling effort was measured as duty cycle—the proportion of time during which the individual was producing sound. †$P < 0.001$; paired *t* test. ‡$P > 0.05$; paired *t* test.

Table 2. Relative performance of offspring of males exhibiting long versus short calls. A shorter larval period is interpreted as better performance. For all other variables, larger values indicate better performance. NS, not significant. Dashes indicate data not collected in 1995.

Parameter	1995		1996	
	High food	Low food	High food	Low food
Larval growth	NS*	Long ≫ short†	Long ≫ short	Long > short‡
Larval period	Long ≫ short	NS	Long ≫ short	NS
Metamorphic mass	NS	Long > short	NS	NS
Larval survival	Long > short	NS	NS	NS
Postmetamorphic growth	–	–	NS	Long ≫ short
MANOVA	$\lambda = 0.96$, df = 3, $P = 0.0887$	$\lambda = 0.81$, df = 3, $P = 0.0590$	$\lambda = 0.90$, df = 4, $P = 0.0143$	$\lambda = 0.71$, df = 4, $P = 0.0216$
Combined probability test	$\chi^2 = 26.67$, df = 8, $P = 0.0008$			

*NS = $P > 0.05$; univariate ANOVA (*24*). †Long ≫ short = $P < 0.01$. ‡Long > short = $0.05 > P > 0.01$.

The specific benefits realized by offspring of long-callers differed among our experimental environments (Table 2). Because variation in the quality of the growth environment is predicted to influence the relation between larval growth and development (*27*), this difference in responses among environments is not unexpected. The consistency of the general benefit realized by offspring of long-callers in our experimental environments suggests that a general performance advantage may be applicable in other environments as well.

Overall, these results provide strong evidence that males with long calls relative to those of other males in the same social environment sired offspring of significantly higher phenotypic quality than males with short relative call durations. We can attribute these observed phenotypic differences to differences in paternal genetic contribution, because our comparison of maternal half-sibships controls for maternal genetic contributions and maternal effects. Thus, our results demonstrate that relative call duration reliably reflects genetic quality in *H. versicolor*. Our data suggest a genetic correlation between sire call duration and offspring performance, which implies that each trait has a heritable basis. The preference for long calls should, therefore, enable females to select high-quality mates and benefit indirectly through increased fitness of offspring. Because female *H. versicolor* do not gain direct benefits from their choice of mate, the indirect genetic benefits we have documented suggest good genes selection as a probable explanation for the evolution and maintenance of the female preference in this species.

REFERENCES AND NOTES

1. A. Zahavi, *J. Theor. Biol.* **53**, 205 (1975).
2. R. D. Howard, H. H. Whiteman, T. I. Schueller, *Evolution* **48**, 1286 (1994); R. D. Semlitsch, *Behav. Ecol. Sociobiol.* **34**, 19 (1994); B. D. Woodward, *Am. Nat.* **128**, 58 (1986); S. L. Mitchell, *Evolution* **44**, 502 (1990).
3. K. Norris, *Nature* **362**, 537 (1993); B. C. Sheldon, J. Merilä, A. Qvarnström, L. Gustafsson, H. Ellegren,

Summer Assignment Name:

After reading the article "Call Duration as an Indicator of Genetic Quality in Male Gray Tree Frogs" answer the following questions. This article is an ABSTRACT – a summary of a scientific research paper.

Scientific method and experiment design analysis:

What is the purpose of the experiment in your own words?

What is the independent (manipulated variable) that is being tested in the experiment?

List at least 5 factors/variables that should be CONTROLLED (kept the same) for this experiment to ensure its validity. You may get these from the text OR come up with ones that are not specifically mentioned

Describe the conclusion of this experiment.

Experimental purpose questions

1. What does the "good genes" model predict about the role of male courtship displays?

2. In testing this model, why was it important to use a species in which females themselves do not DIRECTLY benefit from the choice of a good mate?

3. Explain why the tadpoles that were derived from artificial selection between female and male long callers versus male short callers were reared at two different food levels. ('high food treatment' versus low)

4. The authors conclude that tree frog females choose males based on their call duration. Explain how this preference could have evolved by the process of natural selection together with another mechanism of microevolution (gene flow, mutation, etc.)