Rat/Mouse Evolution Paper HW
Biology 122 – Fall 2015

Name: _____KEY_____

PLEASE ANSWER EACH SET OF QUESTIONS IN **COMPLETE TYPED SENTENCES**. DO **NOT** COPY SENTENCES FROM THE PAPER OR ELSEWHERE, USE YOUR OWN WORDS. DO NOT INCLUDE THE QUESTIONS BELOW IN THE PAPER YOU TURN IN. PLEASE SUBMIT THE ASSIGNMENT THROUGH TURNITIN ON BLACKBOARD.

1. Who defined rapid evolution as occurring over <100 years? Please write 3-4 sentences about him/her.
   Rapid evolution was defined by Theodosius Dobzhansky. He was born in the Ukraine and lived from 1900 to 1975. Dobzhansky was an important American geneticist and evolutionary biologist. He was one of the contributors to the evolutionary synthesis of the early 1900s.

2. Has rapid evolution in island rodents been documented before this paper? If so, what factors were thought to have caused it?
   Yes. 1) Increase in body size was thought to be caused by release of mainland selective pressures. 2) Island area was thought to increase body size, but only in islands up to about 100 km2. 3) Body size was also associated with animals' absolute size: larger mammals tend to become smaller on islands and smaller mammals tend to become larger. 4) Both gross body size and cranial and skeletal traits were thought to become greater on smaller and more remote islands.

3. Where are the rats and mice in this paper located? Please write 3-4 sentences describing the history of this location.
   The rats and mice in this paper are located on Anacapa Island within the California Channel Islands., a chain of eight islands located in the Pacific Ocean off of Ventura. Five of the islands are part of Channel Islands National Park, and the waters surrounding these islands make up Channel Islands National Marine Sanctuary. The islands are oceanic islands with no known land bridge between them since the last Ice Age there about 18,000 years ago. The islands were first colonized by the Chumash native Americans about 13,000 years ago, who were then displaced by European settlers. The Channel Islands and the surrounding waters have a diverse ecosystem with many endemic species and subspecies.

4. What are the scientific names of the rats and mice in this paper?
   Rattus rattus and *Peromuscus maniculatus anacapae.*

What traits were previously documented in rapid evolution of the mice?
The mice were documented to have generally grown smaller, but with bigger ears and noses, between 1940 and 1978.

What do the authors think might be the cause?
The authors think the changes in Anacapa mice may be due to the presence of rats.

5. How many rats were actually measured?
59 rats were measured.

In your own words, please describe each measurement that was taken.
Length of the top row of teeth, braincase width,nose width, braincase depth, skull length, width between the eyes, braincase length, length of a hole in the top of the mouth, length of the top of the mouth, diagonal length of nose, and width of base of nose.

6. What is sexual dimorphism, and what is its relevance to this study?
Sexual dimorphism is difference in size between males and females of the same species. If there was sexual size dimorphism in black rats, the males and females would have to be analyzed separately.

Was sexual dimorphism found in this study?
No.

7. What were the two methods used to evaluate changes over time?
The two methods used to evaluate changes over time were categorical analysis and linear regression.

Why were each used?
Categorical analysis was used 1) because the longest gap between collection years was 35 years, and the next longest gap was only 14 years, and 2) these categories matched the categories when mice were collected, allowing for more direct comparison.
Linear regression was used because categorical analysis compared a very small early (1940) sample (only 12 of the 59 specimens), and linear regression would provide a fairer comparison.

8. Please write 3-4 sentences discussing the differences and pros and cons in the use of darwins vs. haldanes.
   Darwins *measure evolution in years.* Haldanes *measure evolution in generations. Since traits are passed on only between generations, and generation times vary a lot between species,* haldanes *better compare evolution.*

9. Why do the authors think no external measures were found significant?
   The authors think the reason is that sample size was too small.

   Please write 3-4 sentences on the issue of sample size and statistical significance.
   Statistical significance has only two basic components, sample size and difference of results. Statistical significance can be changed as much by having more sample as by having more differences in results.

10. How many cranial traits evolved rapidly in the rats?
    All cranial traits measured (11/11) evolved rapidly in rats.

    Did they get bigger or smaller?
    All traits grew larger.

    How does the rate of evolution of these traits compare to rates found in other organisms?
    "When considered in haldanes, these changes are among the fastest on record in any organism, and far exceed changes found in other island rodents."

11. What traits were found to evolve rapidly in the mice over the same period? Did these get bigger or smaller?
    In general, the mice grew smaller but their noses and ears grew bigger.

12. Please write 4-5 sentences rephrasing (in your own words) the last three paragraphs of the paper. *While cranial rat traits were getting bigger, endemic deer mice were mostly getting smaller, except deer mouse ear ears and noses got bigger. There is no evidence this was due climate change, human population size, or release of selective pressures.*

    Instead, changes in the mice may have been caused by rats. They compete with each other: both eat the same plants and use the same plants for shelter. Rats also prey directly on mice.

If rats did cause mouse evolution, we would predict that after rat eradication mice would get bigger but their noses and ears would get smaller. This could be tested.

Do you agree with the author's conclusions, and why?