**Biology 9: Unit 6 Data Analysis #1 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block: \_\_\_\_**

In humans, Duchenne Muscular Dystrophy (DMD) is a lethal X-linked recessive disorder caused by mutations in the dystrophin gene. Affected individuals show a decline in muscle mass over time along with a decline in muscle strength. One promising area of research in the treatment of DMD involves inhibiting the activity of myostatin, a naturally occurring protein that regulates muscle growth by limiting the development of new muscle cells. Researchers investigating the disorder in mice predicted that inhibition of myostatin would increase muscle mass. Over a period of three months one group of DMD mice (treated) were given injections of anti-myostatin antibody that inhibited myostatin. A second group of DMD mice were untreated (control).

**Figure 1** below shows the differences in body mass during the test period for both groups.



(a) Outline the relationship between body mass and time in the treated group of mice.

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**(2)**

(b) Compare the changes in body mass in the two groups of mice over the test period.

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**(2)**

(c) Predict the results that the researchers would have expected if the experiment was continued beyond 13 weeks in

(i) the treated group.

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(ii) the control group.

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**(1)**

(d) Create a title for the graph above which includes all the variables.

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**(2)**

Further tests were conducted to see whether myostatin inhibition influenced the muscle function of the mice in the study.

**Figure 3** below shows the effect of treatment on muscle strength.



(e) Determine the difference in peak contraction force between the treated group and the control group.

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**(1)**

(f) Evaluate the effectiveness of myostatin inhibition as a treatment for DMD in humans.

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(g) Create a title for the graph above which includes all the variables.

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**(2)**

**Biology 9: Unit 6 Data Analysis #2 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block: \_\_\_\_**

Rats were bred for several generations to prefer alcohol (ethanol) consumption. When tested, it was discovered that the brains of these rats possessed lower quantities of the chemical neuropeptide Y (NPY). To test the hypothesis that lower quantities of NPY leads to a preference for alcohol, rats were genetically engineered to be NPY deficient (genotype NPY –/–), or to produce an excess of NPY (NPY-EX). In separate experiments, the two groups were compared to normal rats (in terms of their alcohol preference) possessing the genotype NPY +/+. The groups were offered solutions of increasing alcohol concentration. The quantity of each solution consumed per day was measured.

**Figure 1** **Figure 2**



(a) Calculate the difference in consumption of the 6% alcohol solution between the

(i) NPY –/– and NPY +/+ rats (figure 1);

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(ii) NPY-EX and NPY+/+ rats (figure 2).

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**(2)**

(b) Compare the alcohol consumption of the NPY –/– rats with the NPY-EX rats.

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**(2)**

(c) Identify the relationship between NPY levels and alcohol consumption.

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**(1)**

An experiment was carried out to test the hypothesis that an increase in preference for alcohol might be related to a decrease in sensitivity to its effects. Rats were injected with a sample of alcohol and then assessed for the length of time it took for them to regain the righting reflex. (The righting reflex refers to the ability of the rat to return to its feet after being placed on its back.)

**Figure 3**



(d) Deduce the relationship between NPY levels and the time required to regain the righting reflex. **(1)**

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An additional experiment was carried out to determine whether differences in sensitivity to the effects of alcohol might be related to differences in the rats’ ability to remove alcohol from their blood. Rats were injected with alcohol and blood samples were taken one hour and three hours later to determine alcohol levels. The results are shown below.

**Figure 4**



(e) Evaluate the hypothesis that differences in sensitivity to the effects of alcohol might be related to differences in the ability of the rats to remove alcohol from their blood. **(1)**

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(f) (i) Define the term *homozygous*. **(1)**

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(ii) State the phenotype of a rat with the genotype NPY +/+. **(1)**

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(iii) Using a Punnett grid, predict the fraction of offspring that would have the genotype NPY +/– if two rats were crossed, one homozygous for the NPY+ allele and one homozygous for the NPY– allele. **(2)**

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