BIO 300 ASSIGNMENT #8

NOTE: This assignment is due Friday November 12th.

1. An experiment was recently carried out to measure the effects of interactions between two fish species, threespine stickleback and cutthroat trout, on growth rate of sticklebacks. The experiment was carried out in a set of ponds previously emptied of fish. Since the ponds differed from one another in productivity and water quality, the experiments decided to divide each pond in half by placing a divider down the middle. 500 baby sticklebacks were added to one side of each pond, and 500 baby sticklebacks plus 500 baby trout were added to the other. The mean body lengths of sticklebacks (in mm) after six months in each pond are shown below.

Pond	1	2	3	4	5	6	7	8	9
Trout present	21.5	26.5	22.3	28.4	23.2	32.2	14.7	18.1	19.3
Trout absent	19.3	27.8	22.7	32.8	22.9	35.8	17.9	19.7	24.3

   (a) Why do you think the experimenters use a split-pond experimental design?
   (b) Test whether interactions with trout influences stickleback growth. Assume that **none** of the assumptions about normal distributions are met in this case.
   (c) Why is a parametric test preferred over a nonparametric test when its assumptions can be met?
   (d) What would the appropriate parametric test be for the above data, if the assumptions could have been met?

2. Red crossbills are a species of finch that possess a highly modified beak (the mandible tips are long and crossed) thought to <u>reduce</u> the time required to extract seeds from conifer cones, their major food. To test this, a researcher captured a random sample of 10 crossbills. On 5 of the birds he removed completely the crossed tips. On the other 5 he clipped only a tiny portion of their beak tips, which remained long and crossed (these 5 birds therefore served as controls). He allowed two weeks for the birds to become accustomed to their "new" beaks, and then he measured their feeding rates. The mean time to extract a seed from a cone is shown below for each bird. Did removing the beak <u>increase</u> the mean time to extract a seed? Use the most powerful test and make all necessary assumptions.

Control	**Tip Removed**
4.0	3.5
4.5	5.3
3.6	6.1
5.3	5.7
2.6	6.1

3. In 1964 Ehrlich and Raven proposed that novel, effective plant defenses against attack by herbivores would spur plant diversification. A recent test of this idea compared species diversity between paired 'sister lineages' differing in plant defenses. Sister lineages share a common ancestor and are therefore the same age. The data set consisted of 16 sister-lineage pairs. Plant species belonging to one of the lineages of each pair possess latex and resin canals, whereas species belonging to the other lineage do not. In 13 of the 16 pairs the lineage with canals was found to be the more diverse, whereas in the other 3 pairs the sister lineage lacking the canals

was found to be the more diverse.

(a) With these data test whether species diversity differs between lineages possessing latex and resin canals.
(b) Is this a controlled experiment or an observational study? Why.

4. A large data base gathered over a 10-year period in a midwestern town (n = 12,498 individuals) was analysed to determine predictors of high serum cholesterol. Twenty-eight different dietary factors were examined. It was found that serum calcium levels were significantly negatively associated with serum cholesterol levels ($P<0.05$). The researchers concluded that low calcium causes high cholesterol. They recommended that one should increase milk consumption to lower cholesterol levels. Can you provide three reasons to question their conclusion?

5. In a study of hypnotic suggestion, ten male volunteers were randomly allocated to an experimental and a control group. Each subject participated in a two-phase experimental session. In the first phase, respiration was measured while the subject was awake and at rest. In the second phase, the subject was told to imagine he was performing muscular work, and respiration was measured again. Subjects in the experimental group were hypnotized in the second phase, while subjects in the control group were not. Respiration rates (in litres air per minute per m^2 of body area) were as follows:

Experimental			*Control*		
Subject	Rest	Work	Subject	Rest	Work
1	5.74	6.24	6	6.21	5.50
2	6.79	9.07	7	4.50	4.84
3	5.32	7.77	8	4.86	4.91
4	7.18	9.46	9	4.78	6.08
5	5.60	6.95	10	4.79	4.88

With these data, test for an effect of hypnosis on simulated work respiration rates.

6. In a study of hormonal control of aggression, an experimenter surgically implanted testosterone-releasing capsules under the skin of nine randomly-sampled rhesus monkeys. Nine other monkeys were sham-operated and these are the controls. A series of trials was then conducted in which one experimental and one control monkey were placed together in a room. The number of aggressive acts that each monkey carried out on the other (chases, strikes, etc.) was recorded over a twelve-hour period. The results are given below.

Pair	1,	2	3	4	5	6	7	8	9
Testosterone monkey	34	26	15	5	19	60	30	21	12
Control monkey	4	12	7	2	3	36	12	6	4

(a) Produce a 95% confidence interval for the difference between testosterone and control monkeys in the mean number of aggressive acts. Make all necessary assumptions.
(b) The number of aggressive acts in control monkeys has a highly skewed distribution. Is this a problem for your analysis in (a)?