MULTIPLE CHOICE.—For the following multiple choice questions circle the letter in front of the response that best answers the question or completes the sentence. (10%, 1% each)

1. According to Dr. Ghedotti why do scientists usually sound so tentative?
   a. Because neurotics are always tentative and scientists are neurotic.
   b. Because scientists are being political about it.
   c. Because scientists cannot reject something as incorrect.
   d. Because scientists must maintain doubt about all their conclusions.

2. Which of the following is a group that receives the treatment (thing of interest) in a scientific study?
   a. experimental group
   b. control group
   c. focus group

3. A person with the blood type AB likely could safely receive a transfusion of a pint of which of the following blood types?
   a. Type A only
   b. Type AB only
   c. Type B only
   d. Type O only
   e. Types AB or O only
   f. Types A or B only
   g. Types A, AB, or B only
   h. Types A, AB, B, or O

4. Which of the following describes the ABO blood system genotype of someone with type O blood?
   a. I^A^B
   b. I^A^ or I^A^A
   c. I^B^ or I^B^B
   d. ii

5. If a both the mother and the father are carriers of cystic fibrosis (have the allele but don’t exhibit the disease), what is the chance that they’ll have a child with cystic fibrosis?
   a. 100%
   b. 75%
   c. 50%
   d. 25%
   e. 0% (no chance)

6. Which of the following cells engulfs and destroys pathogens or cellular debris?
   a. macrophages
   b. helper T cells
   c. memory B cells
   d. memory T cells
   e. plasma B cells

7. Which of the following is the cause of Down Syndrome?
   a. Three copies of chromosome 1
   b. Three copies of chromosome 21
   c. XYY – three chromosome 23
   d. XXX – three chromosome 23
   e. XXY – three chromosome 23

Use the following nutrition label to answer questions 8, 9, and 10.

<table>
<thead>
<tr>
<th>Nutrition Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serving Size 1/2 cup (114 g)</td>
</tr>
<tr>
<td>Amount Per Serving</td>
</tr>
<tr>
<td>Calories 90</td>
</tr>
<tr>
<td>Total Fat 3g</td>
</tr>
<tr>
<td>Saturated Fat 0g</td>
</tr>
<tr>
<td>Cholesterol 0mg</td>
</tr>
<tr>
<td>Sodium 300mg</td>
</tr>
<tr>
<td>Total Carbohydrate 13g</td>
</tr>
<tr>
<td>Dietary Fiber 3g</td>
</tr>
<tr>
<td>Sugars 3g</td>
</tr>
<tr>
<td>Protein 3g</td>
</tr>
</tbody>
</table>

8. How many grams of cellulose does one serving contain?

9. How many grams of starch does one serving likely contain?

10. How much of more-healthy (less unhealthy) fat does one serving likely contain?
PEDIGREE ANALYSIS (GENETIC MEDICAL HISTORY ANALYSIS)

1. For the pedigree below (individuals with the disorder are depicted as black/colored in) indicate if it is dominant or recessive and sex-linked or not. Circle = female. Square = male. (2%)

In a brief sentence explain why the individuals in generation IV and all future children had by individuals III-2 and III-3 will have the disorder. (1%)

2. For the pedigree below (individuals with the disorder are depicted as black/colored in) indicate if it is dominant or recessive and sex-linked or not. Circle = female. Square = male. (2%)

LABELING.—For the following identify and label as indicated.

3. Label the 4 types of molecules visible on the structure below (6%).

4. Label each of the two molecules below.

   (a.) _____________________________  (2%)

   (b.) _____________________________  (2%)
DEFINITIONS.—Define each biological/scientific word below in as concise and clear a manner as possible. (10%, 2% each)

1. Allele

2. Antigen

3. Embryonic Stem Cells

4. Hematocrit

5. Sex-Influenced Trait (Disorder):

SHORT ANSWER.—Address each question in as concise and lucid a manner as possible. Do NOT exceed the space provided.

1. A pregnant friend of yours had phenylketonuria when he was a child and had to eat a very restrictive diet until she went to college. Her husband has had genetic testing knows that he is a carrier of the recessive phenylketonuria allele. (5%)

   What is the likelihood that your friend’s child will have phenylketonuria, and what is the likelihood that her child will be a carrier of phenylketonuria but will not have the disease?

   Generally (in a sentence) explain to your friend what the consequences of not being on a restrictive diet would have been for her (had she not followed the diet when young).
2. (a.) Briefly explain the genetics of the Rh blood type (positive or negative blood type). What occurs based on possession of the Rh+ allele and what occurs when someone has the Rh- allele? Which allele is dominant or is a co-dominance system? (3%)

(b.) Explain when and how this blood type system can be of concern during pregnancy. (3%)

3. Generally explain what happens during transcription and where it occurs. (2%)

4. Generally explain what happens during translation and where it occurs. (2%)
MULTIPLE CHOICE.—For the following multiple choice questions circle the letter in front of the response that best answers the question or completes the sentence. (10%, 1% each)

1. Based on its word parts what does gastritis mean?
   a. intestine-inflammation
   b. intestine-removal
   c. intestine- small (diminutive)
   d. liver-inflammation
   e. liver-removal
   f. liver- small (diminutive)
   g. stomach-inflammation
   h. stomach-removal
   i. stomach-small (diminutive)

2. Carbon atoms tend to form how many bonds?
   a. 1
   b. 2
   c. 3
   d. 4
   e. 5

3. Which of the following is what a buffer does?
   a. Breaks apart starch molecules.
   b. Copies DNA.
   c. Helps maintain a specific pH.
   d. Makes oxygen.

4. The OH\(^{-}\) molecule has…
   a. equal numbers of protons and electrons.
   b. more electrons than protons.
   c. more electrons than neutrons.
   d. more neutrons than electrons.
   e. more neutrons than protons.
   f. more protons than electrons.
   g. more protons than neutrons.

5. Which of the following is FALSE about a water molecule?
   a. It contains 2 hydrogen and 1 oxygen atoms.
   b. It has a more negative and a more positive end.
   c. It is very strongly bonded and can never breaks apart.
   d. It lacks nitrogen atoms.
   e. None of the above. (All are true about water.)

6. Which of the following cells releases free antibodies into the plasma?
   a. macrophages
   b. helper T cells
   c. memory B cells
   d. memory T cells
   e. plasma B cells

7. Which of the following is NOT found in a benign tumor? (But IS found in a malignant tumor.)
   a. Cells do not stick together well.
   b. Cells do not stop dividing when contacting other cells.
   c. Cells have a genetic abnormality due to a mutation.

8. Which of the following would describe condition that would result if someone was given a pure water IV (putting pure water into someone’s bloodstream)?
   a. hemolytic anemia
   b. hemorrhagic anemia
   c. hyperglycemia
   d. hypoglycemia
   e. leukemia
   f. pernicious anemia
   g. phenylketonuria
   h. nothing, it’s appropriate

9. What type of molecules are the ABO-system blood type antigens?
   a. carbohydrates
   b. lipids.
   c. nucleic acids
   d. proteins

10. A person with the blood type AB- (negative) likely could safely receive a transfusion of a pint of which of the following blood types?
    a. Types AB+, AB-, A+, A-, B+, B-, O+, & O- only
    b. Types AB+, A+, B+, & O+ only
    c. Types AB-, A-, B-, & O- only
    d. Types AB+, A+, & B+ only
    e. Types AB-, A-, & B- only
    f. Types A+, & B+ only
    g. Types A-, & B- only
    h. Type AB+ only
    i. Type AB- only
**MATCHING.**—For the following exercise match the component substances in the right column, with the corresponding complex molecule in the left column. *Each letter may be used more than once or not at all.* (5%, 1% each)

1. Starch ________ A. 3 hydrocarbon chains
2. Protein ________ B. 4 fused hydrocarbon rings
3. Glycogen ________ C. Amino acids
4. DNA ________ D. Collagen molecules
5. Cellulose ________ E. Glucose molecules
   ________ F. Nucleotides

**SCIENCE.**
1. In the space below briefly (using bullet points) identify what you would look for in a scientific or clinical study or the efficacy of a drug or treatment to be confident in the conclusions. (6%)

**LABELING.**—For the following generally describe what is happening in the indicated stages.

What happens between 1 and 2? (1%)

What happens between 2 and 4? (1%)

What happens between 4 and 5? (1%)

What happens between 6 and 9? (1%)
DEFINITIONS.—Define each biological/scientific word below in as concise and clear a manner as possible. (10%, 2% each)

1. Cancer

2. Genetic Medicine

3. Hemorrhagic Anemia

4. Immunization  (include what it does cellularly/immunologically)

5. Reverse Transcriptase

SHORT ANSWER.—Address each question in as concise and lucid a manner as possible. Do NOT exceed the space provided.

1. Sketch the basic structure of a human cell, label the major structures, and indicate which types of biological molecules form each of the structures. (5%)
2. (a.) Provide the chemical equations for the carbonate buffer system. (Use chemical equations for your answer.) (1%)

(b.) Briefly explain how the above equations relate to how carbon dioxide is transported in the blood. Or, put another way, how is most carbon dioxide transported in the blood? (2%)

(c.) If someone cannot get rid of carbon dioxide normally because of a problem with lung function, what will eventually happen to that person’s blood pH (and why)? What symptoms if any would eventually result? (2%)

3. Explain what occurs in the inflammatory response including what happens at the cellular/tissue level, the clinical symptoms of inflammation, and the cellular/tissue level cause of each of the clinical symptoms. (5%)