Case Study

What factors determine the effectiveness of drugs?

Open up the website http://www.campbellbiology.com From the pull down menu select Chapter 4: Carbon and the Molecular Diversi
ty of Life. Under the section Concept 4.2, choose Investigation: What Factors Determine the Effectiveness of Drugs?

Read the information that is in the upper right quadrant of the screen and follow its directions. You will be able to type in data directly in the Lab Notebook and answer the Question in the boxes given, but make sure you enter all information on this sheet to keep in your binder.

1. Read the paragraphs at the top of the window. Click on each of the buttons below the girl in the bed to learn more about the three factors that determine a drug’s effectiveness and safety. If at any time you want to go back to the girl in the bed part, click replay at the top of the window.

2. Answer the following questions as you explore the three factors. (These are the same questions that are in the Lab Report portion of the window)

   a. Many medicines can only be stored for a certain period of time, and then they must be disposed. Hypothesize why aging can affect a drug’s ability to work.

      Chemical bonds between the atoms making up the drug molecule may start to weaken and break down over time. If you change the chemical structure of a molecule, you change its chemical function.

   b. Hypothesize why many drugs lose their effectiveness quicker if a person drinks lots of coffee, tea, or water while taking a drug.

      Medications are going to be carried through the body via the bloodstream (bonded to proteins in the blood). As a person drinks more water based liquid, the kidneys filtration of the blood increases (you produce more urine) thus filter out more of the medication before it has the chance to reach the part of the body it is destined for.

   c. The dosages for certain drugs given to epileptic patients are different for females and males.

      Propose an explanation for this medical practice.

      Males and Females metabolize (the breaking down or building of molecules) molecules at different rates.

Results of patients taking several forms of Reboxetine.

3. Click on the next button at the top of the page to go to slide two. Once you have read the section on the right of the window, click on each bottle to get the results for each group. Fill in the data table below. Make sure you are familiar with what each of the abbreviations stand for. Answer questions 4 - 7 on the next page.

<table>
<thead>
<tr>
<th>Results</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>Group D</th>
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</tbody>
</table>
4. What general observation can you make about the effect of the drug produced by the plant?

More patients in the study saw greater effects from the drug produced from plants than from the synthetic drug. We also see a fair number of patients with side effects.

5. What general observation can you make about the effect of the drug produced by the genetically engineered yeast?

In general, those patients taking the drug produced by genetically engineered yeast saw less effect than the synthesized reboxetine. We also see a higher number of patients with less effect AND side effects.

6. What general observation can you make about the results for group C?

Patients continuing to take the synthesized reboxetine report mostly the same effect. We do see some variation in effects seen.

7. What general observation can you make about the results for group D?

The control group saw no effect (some with side effects) in 90% of the patients. This is expected as the control patients are not getting any medication. (Patients seeing effects are part of the placebo effect)

Click on next at the top of the page to forward to slide three. Read the information on the right side of the window. Use the graph and information about enantiomers to answer questions 8 and 9 below.

8. How might the differences in the enantiomers of reboxetine help explain the different results for groups A, B, and C?

The molecules that are enantiomers do not function the same. The two molecules below are enantiomers (L-dopa and D-dopa). Since the structures are different, their function is different and in this case, D-dopa doesn’t work. If there are enatiomers of reboxetine found within the medication reboxetine (and there will be), those molecules won’t work and we will see no effect or less effect on depression.

9. What factors might explain the different responses within each trial group?

type of depression, placebo effect, length on medication, gender, age, presence of side effects (think of different variables that may affect drug effectiveness)