

Pathogen Modeling Program Formal Report

Module: Food Poisoning and Food Safety

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Introduction:

Bacterial growth is influenced by intrinsic and extrinsic parameters. This formal report is for you to investigate the affect of particular parameters on a given pathogen. You each have been given a specific pathogen to investigate.

You have access to the Pathogen Modeling Program and although the deadline may seem a long time away, if you're unfamiliar with the program then you'll spend a lot of time before getting quotable results.

This computer simulation practical is partially open-ended in that it is up to you the exact values of the parameters for altering. The main parameters for altering are temperature, pH and water activity. You should start by looking up the growth ranges of your organism and you should compare those values with your results from the computer simulation, they may agree or disagree. You should also use your knowledge of the organism to decide on 'representative' growth conditions, inoculum size and level of concern (cf PHLS Ready to Eat guidelines which is accessible via the module timetable from www.theagarplate.com).

The American USDA freeware program has been installed in rooms ED289, 290, 291 and 293. You get to it via 'Start' – 'Science' - 'Life Sciences' – 'Microbiology'. It should be version 6.1. If you wish to download your own copy of the program then go to <http://www.arserrc.gov/mfs/PATHOGEN.HTM> and register to obtain a zipped version.

The following instructions are for Pathogen Modeling Program version 6.0. It is plausible that a newer version will be available (I have a trial version of 7.0) and you therefore may have to use different series of instructions appropriately. If you have version 5 then you will be able to do more than version 6, since the latter does not have the 'multiple growth' option.

Note: Another source of information you could use for this formal report is 'Combase' at <http://wyndmoor.arserrc.gov/combase/>. Simply click on 'start search' as there is no need to register.

Instructions:

Part 1. Familiarisatio, not for submission in formal report.

Run the program version 6.

Click on 'Bacteria ->Models' on the top line.

From the pull down menu click on the name of your organism.

Click on 'Aerobic' or 'Anaerobic' according to the normal growth conditions of your organism.

Immediately the window gives default values for a number of parameters including; temperature, pH, sodium nitrate etc. **MAKE A NOTE OF THESE NOW.**

Familiarisation (1)

Briefly alter the parameters such as reducing the temperature and observe the change on the growth curve.

Return the temperature to the default setting.

Change the pH and observe the affect on the growth curve.

Return the pH to the default setting.

Change the sodium chloride and observe the affect on the growth curve and also note the 'Calculated Water Activity' .

Return the sodium chloride to the default setting

Famiiliarisation (2)

Note the population initial level and level of concern

The time taken to reach the 'Level of Concern' from a given inoculum is shown in the right-hand grey box in both hours and days.

Alter the inoculum value and see how the 'Time to Level of Concern' changes.

Familiarisation (3)

Alter the temperature and note the changes in 'Lag Phase Duration' and 'Generation Time'.

Part 2. Influence of temperature, pH and water activity on microbial growth

(a) Ensure all settings are on the default values

Set the inoculum size to 100 cells and the level of concern to 100000 cells

(b) At regular intervals reduce the temperature and tabulate:

Temperature (etc) Lag time Generation time Time to level of concern

(c) Return the temperature to the default value and repeat only this time alter the pH value. Tabulate as per (b).

(d) Return the pH to the default value and repeat, but altering the sodium chloride value only this time also record the water activity. Tabulate as per (b).

Part 3. Relationship of initial microbial load and time to level of concern.

(a) Ensure all settings are on the default values

Set the inoculum size to 100 cells

Set the level of concern to 100000 cells

Alter the inoculum size at regular intervals and tabulate :

Inoculum size	Time to level of concern
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If the inoculum size is reduced 10-fold (ie 100 to 10) does the 'Time to Level of Concern' increase 10-fold? If not, why not?

Part 4. Simulation of microbial growth and product

Using your background knowledge of the organism's growth requirements (aerobic-anaerobic), growth parameters (pH, temperature, water activity) decide on your own investigation of the program. For example if your organism is found in meat then set the pH to 6.5 and if the infectious dose is 10^6 cfu/g then set the 'Level of Concern' accordingly.

Alter the temperature and water activity to investigate the requirements of the organism and how food needs to be processed in order to avoid food poisoning.

Part 5. Combase

If you are using version 6 then access 'Combase' via the web address on the first sheet and obtain data related to your organism and associated foodstuff.

Part 5. Multiple growth parameters – only for version 5 users.

If you are using version 5, then

(a) Close the 'Individual growth' window.

(b) Click on 'Models', then 'Multiple growth'.

(c) Choose your organism and two or more others.

(d) Alter the parameters and decide if your organism is more or less sensitive to the parameters than the other organisms. Note that in this part of the program you can alter the atmosphere between aerobic and anaerobic.

Final report.

You need to write a description of the organism including its growth requirements, infectious dose and typical associated foods. This forms the background to your studies.

Reproduce the tabulated results in a coherent fashion. You may decide to plot the data to show any relationships between pH and 'Level of Concern', etc.

Discuss how well (or otherwise) the program simulates the organism by comparing with your background information.

Discuss the usefulness in industry of the Program.

Since this is a formal report you need to give detailed references.