Use-Case Scenarios for Molecular Genetics eXplorer

Executive Summary

Software developers rely on use cases as they model the requirements for new applications. Each formal use case that the developers write is associated with a set of informal narratives. These narratives, called use-case scenarios, serve to establish the nature of the interactions that will take place between the user (the actor) and the planned application (the system). It is therefore important for the success of a software project that the customers as well as the developers review and agree on the use-case scenarios.

The Molecular Genetics eXplorer (MGX) is a computing application that will help students to understand the connections between genetics, molecular biology, and biochemistry. There are three virtual laboratories in MGX: Virtual Genetics Lab (VGL, genetics), GenExplorer (Genex, molecular biology), and Protein Explorer (Protex, biochemistry). MGX use-case scenarios are grouped according to type of user—student or administrator--and operating mode—integrated or stand alone. In integrated mode, MGX will display a zoo of creatures, and each laboratory will make use of creatures taken from this zoo. In stand-alone mode, MGX will not display any zoo, and each laboratory will function as it currently does outside of MGX, that is, as a stand-alone application.

The following sets of of use-case scenarios are presented in this document. A customer signature area is found at the end of each set of scenarios.

Scenarios S-SA:	Student-Stand Alone
Scenarios S-I:	Student-Integrated
Scenarios A-SA:	Administrator-Stand Alone
Scenarios A-I:	Administrator-Integrated

Scenarios S-SA
Student-Stand Alone

S-SA.1. The student opens MGX in stand-alone mode (S-SA).

The student starts the application. MGX displays a list of choices: *New Session*, *Saved Session* and *Quit.*

S-SA.1.1 *New Session*

The student selects *New Session.* MGX displays one, two or three laboratory tabbed panes (LTPs). These LTPs offer the student a choice of labs to work in. The administrator controls the list of choices, but the possible choices are Virtual Genetics Lab (VGL), GenExplorer (Genex) and Protein Explorer (Protex). In each of these labs, MGX displays the same interface as would appear if that lab were to be run as a stand-alone application. There is no zoo holding creatures. Each lab may exhibit more features and functionality than it does in MGX-Integrated mode (see below, S-I).

S-SA.1.2 *Saved Session*

If the student has already used MGX, and wants to start where she left off, she selects *Saved Session*. MGX prompts for name of file holding the last saved state. The student provides the filename. MGX loads the saved state, and displays one, two or three LTPs, as is described above (S-SA.1.1).

S-SA.1.3 *Quit*

The student selects *Quit*. MGX quits.

S-SA.2. In VGL.

See http://intro.bio.umb.edu/VGL/index.htm.

S-SA.3. In Genex.

See http://intro.bio.umb.edu/GX/.

S-SA.4. In Protex.

See http://www.cs.umb.edu/~eb/folding/.

S-SA.5. The student prints the results of her session.

The student selects *Print*. MGX sends the results or state of the current session to the printer.

S-SA.6. The student closes MGX in stand-alone mode.

The student chooses to exit the application. MGX prompts for the name of a file it will use for saving its state. The student enters a filename, or indicates that she wants MGX to discard the session. If she enters a filename, MGX saves its state. MGX quits.

Signature

I approve the use-case scenarios for S-SA: Student-Stand Alone.

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Professor Brian White, Customer   Today's Date

Scenarios S-I
Student-Integrated

S-I.1. The student opens MGX in integrated mode (S-I).

The student starts the application. MGX displays a list of choices: *New Session*, *Saved Session*
and *Quit.*

S-I.1.1 *New Session*

The student selects *New Session.* MGX displays a zoo holding creatures and one, two or three
laboratory tabbed panes (LTPs). These LTPs offer the student a choice of labs to work in. The
administrator controls the list of choices, but the possible choices are Virtual Genetics Lab
(VGL), GenExplorer (Genex) and Protein Explorer (Protex).

In Virtual Genetics Lab (VGL), the student mutates the genotype of a single creature for one trait
(color), and observes the resulting changes in its phenotype; or the student crosses two creatures,
and examines their progeny. In GenExplorer (Genex), the student interprets the transcription and
translation of DNA to protein. In Protein Explorer (Protex), the student visualizes the unique
structure and function of a protein.

S-I.1.2 *Saved Session*

If the student has already used MGX, and wants to start where she left off, she selects *Saved*
Session. MGX prompts for name of file holding the last saved state. The student provides the
filename. MGX loads the saved state, and displays one, two or three LTPs, as is described above
(S-I.1.1).

S-I.1.3 *Quit*

The student selects *Quit*. MGX quits.

S-I.2. In VGL.

In VGL mode, MGX displays a large cage that is either empty or holding creatures, and one or
two small cages that can hold just one creature.

S-I.2.1. In VGL, the student selects one creature.

The student selects one creature from the zoo or from the large cage. MGX displays the selected creature in a small cage and shows its genotype. MGX enables a button labeled *Mutate*. The student pushes this button, and MGX randomly mutates the genes of the selected creature. The student sees changes in the genotype of this creature, and observes possible changes in its phenotype (color).

S-I.2.2. In VGL, the student selects two creatures.

Student selects two creatures: both from the zoo, one from the zoo and one from the large cage, or both from the large cage. MGX displays each selected creature in one of the two small cages. MGX enables a button labeled *Cross*. The student pushes this button. MGX first clears the large cage, and then displays all of the offspring of the two selected creatures in the large cage. The student saves creatures she wants to keep for further study by dragging them into the zoo from the large cage and/or from the small cages.

S-I.3. In Genex, the student selects one creature.

The student selects a creature from the zoo. MGX displays the selected creature in a small cage large enough to hold a single creature, separate from the zoo. MGX also displays in two separate boxes the DNA sequence, which is *editable*, the (messenger) RNA and the protein associated with the two genes determining one trait (color) taken from a homologous pair of chromosomes. The student edits the nucleotides in the DNA sequence associated with either of the genes. MGX modifies the associated messenger RNA, the protein and the appearance (color) of the creature in the cage.

S-I.4. In Protex, the student selects one creature.

In Protex, MGX displays a palette holding the 20 common amino acids. The student selects one creature from the zoo. MGX displays the selected creature in a small cage. MGX also displays *editable* copies of the polypeptide chain (linear and folded) plus the function (color) of the protein associated with two genes (alleles) from a homologous pair of chromosomes. Student adds/removes one amino acid to/from the existing polypeptide chain of either gene. MGX folds the modified polypeptide chain, displays its altered function (color), and modifies the appearance of the selected creature in the small cage.

S-I.5. The student prints the results of her session.

The student selects *Print*. MGX sends the results or current state of the session to the printer.

S-I.6. The student closes MGX in integrated mode.

The student chooses to exit the application. MGX prompts for the name of a file it will use for saving its state, including all creatures in the zoo and in cages (VGL). The student enters a filename, or indicates that she wants MGX to discard the session. If the student enters a filename, MGX saves its state. MGX quits.

Signature

I approve the use-case scenarios for S-I: Student-Integrated.

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Professor Brian White, Customer   Today's Date

Scenarios A-SA
Administrator-Stand Alone

A-SA.1. The administrator opens MGX in stand-alone mode (A-SA).

The administrator starts the application. MGX displays a list of choices: *New Session*, *Saved Session* and *Quit.*

A-SA.1.1 *New Session*

The administrator selects *New Session.* MGX displays an options tabbed pane (OTP) and one, two or three laboratory tabbed panes (LTPs). The labs are Virtual Genetics Lab (VGL), GenExplorer (Genex) and Protein Explorer (Protex). In each of these labs, MGX displays the same interface as would appear if that lab were to be run as a stand-alone application. There is no zoo holding creatures. The function of each lab is the same as that of its stand-alone version *running in administrator mode*.

A-SA.1.2 *Saved Session*

If the administrator has already set up MGX, and wants to implement his custom configuration, he selects *Saved Session.* MGX prompts for name of file holding the last saved state. The administrator provides the filename. MGX loads the saved state, and displays the OTP plus one, two or three LTPs, as is described above (A-SA.1.1).

A-SA.1.3 *Quit*

The administrator selects *Quit*. MGX quits.

A-SA.2. In VGL.

See http://intro.bio.umb.edu/VGL/index.htm, administrator mode.

A-SA.3. In Genex.

See http://intro.bio.umb.edu/GX/, administrator mode.

A-SA.4. In Protex.

See http://www.cs.umb.edu/~eb/folding/, administrator mode.

A-SA.5. The student closes MGX in stand-alone mode.

The administrator chooses to exit the application. MGX prompts for the name of a file it will use for saving its state. The administrator enters a filename, or indicates that he wants MGX to discard the session. If he enters a filename, MGX saves its state. MGX quits.

Signature

I approve the use-case scenarios for A-SA: Administrator-Stand Alone.

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Professor Brian White, Customer   Today's Date

Scenarios A-I
Administrator-Integrated

A-I.1. The administrator opens MGX in integrated mode (A-I).

The administrator starts the application. MGX displays a list of choices: *New Session*, *Saved Session* and *Quit.*

A-I.1.1 *New Session*

The administrator selects *New Session.* MGX displays a zoo holding creatures, an options tabbed pane (OTP) and one, two or three laboratory tabbed panes (LTPs). In the OTP, the administrator is able turn on and off all three labs. He is also able to add and remove creatures from the zoo. An LTP that is turned off is not visible.

The LTPs correspond to those labs that the administrator wants the students to choose from-- Virtual Genetics Lab (VGL), GenExplorer (Genex) and Protein Explorer (Protex). The appearance, features and functionality of each lab in its LTP are the same for the administrator as they are for the student in scenarios S-I.2 through S-I.4.

A-I.1.2 *Saved Session*

If the administrator has already set up MGX, and wants to implement his custom configuration, he selects *Saved Session*. MGX prompts for name of file holding the last saved state. The administrator provides the filename. MGX loads the saved state, and displays the OTP plus one, two or three LTPs, as is described above (A-I.1.1).

A-I.1.3 *Quit*

The administrator selects *Quit*. MGX quits.

A-I.2 In VGL.

See scenario S-I.2.

A-I.3 In Genex.

See scenario S-I.3.

A-I.4 In Protex.

See scenario S-I.4.

A-I.5. In the OTP.

In the OTP, MGX displays a creature supply pool (CSP) where the administrator can store creatures temporarily. There is an option to choose among the LTPs. If the option is selected (turned on), the corresponding LTP is visible.

A-I.5.1. In the OTP, the administrator turns on/off VGL.

The administrator clicks on the VGL check box. MGX adds/removes the VGL tabbed pane to/from the visible LTPs.

A-I.5.2. In the OTP, the administrator turns on/off Genex.

The administrator clicks on the Genex check box. MGX adds/removes the Genex tabbed pane to/from the visible LTPs.

A-I.5.3. In the OTP, the administrator turns on/off Protex.

The administrator clicks on the Protox check box. MGX adds/removes the Protex tabbed pane to/from the visible LTPs.

A-I.5.4. In the OTP, the administrator populates the zoo.

The administrator pushes a button labeled *More Creatures.* MGX prompts for the name of a file holding creatures for the supply pool. The administrator enters a filename. (MGX accepts for this purpose old state files holding creatures saved by students.) MGX loads the creatures in this file into the CSP. The administrator selects creatures from the CSP, and moves them (by drag and drop) into the zoo area.

A-I.5.5. In the OTP, the administrator depopulates the zoo.

The administrator selects creatures from the zoo, and moves them (by drag and drop) into the CSP. The administrator pushes a button labeled *Discard Creatures.* MGX prompts for the name of a file to hold (save) the discarded creatures. The administrator enters a filename or indicates that he does not want to save them. If the administrator does enter a filename, MGX saves in this file all of the creatures that are in the CSP, and clears the CSP.

A-I.6. The administrator closes MGX in integrated mode.

The administrator chooses to exit the application. MGX prompts for the name of the file it will use for saving its state and options. The administrator enters a filename, or indicates that he wants MGX to discard the session. If the administrator enters a filename, MGX saves its state, including options and creatures in the zoo and in cages (VGL). MGX quits.

Signature

I approve the use-case scenarios for A-I: Administrator-Integrated.

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Professor Brian White, Customer   Today's Date