User Manual

Gene Tracker
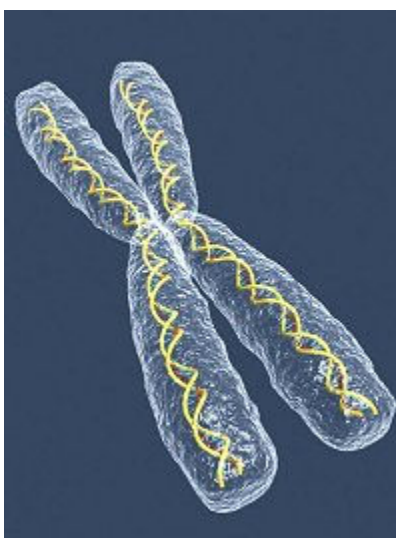
Table of Contents

Preface

This is the Gene Tracker User Manual. This Manual will provide detailed explanations on how to use Gene Tracker. This Manual provides instructions on how to properly install Gene Tracker on your target platform, load the program, create a new simulation, load a previous simulation, view the results, and export the result data. Gene Tracker also has a built in tutorial that will walk the user through the execution of a basic simulation.

About Gene Tracker

Gene Tracker is a tool that will help in the understanding of how chromosomes pass on male dominance. It takes a variety of input values such as: founding population, crossover, mate choice, skew in mating, initial dominance distribution, dominance inheritance, and simulation. Gene Tracker was created specifically to Dr. Yvonne Chueh and Dr. Lixing Sun specifications to help in their research work. Students will use Gene Tracker in a lab environment with a computer.

The Development Team

Team Gattaca developed Gene Tracker as a senior project at Central Washington University in Ellensburg Washington. Team members included Team Leader Toby Lewandoski, Lead Programmer Blair Sherman, Quality Assurance Manager Loren Harris, and Lead Tester Jacob Odiaga. Their faculty advisor was Dr. Razvan Andonie of the Computer Science Department. The Clients were Dr. Yvonne Chueh of the Mathematics Department and Dr. Lixing Sun of the Biology Department.

System Requirements

1. CD-Rom drive

2. 128 MB RAM [Minimum] 512 MB RAM [Recommended]

3. 100 MB available disk space for the installation Gene Tracker and its required library

4. Windows XP

5. Windows Installer 3.1 & Microsoft .NET Framework

Installation of Gene Tracker

Installation of Gene Tracker is very simple and easy. There are two methods to install, the Auto-Run Install, and the Manual Install.

Auto-Run Install

1. Insert the CD-ROM labeled Gene Tracker, into your CD-ROM drive.

2. Follow the directions that are given from the pop-up installer.

3. Select the destination path folder to install the Gene Tracker program.

4. Select Finish after the completion of the install.

Notes: Included on disk in Folder named Requirements

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1. Make sure windows installer 3.1 is installed
2. If gene tracker does not work, make sure Microsoft .Net Framework is installed

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Manual Install

1. Click on the start menu.

2. Click on the run option

3. Select browse and find your CD-ROM drive. Open your File folder with Setup.exe

4. Select the Gene Tracker Setup.exe then press open.

5. Press OK to begin the installation of Gene Tracker.

6. Follow the directions that are given from the pop-up installer.

7. Select the destination path folder to install the Gene Tracker program.

8. Select finish after the completion of the install.

Starting the Program

After installing Gene Tracker on the target system, the computer will be ready to run the software. The computer may also have a Gene Tracker Startup shortcut placed on the desktop for quick launching. To start the user will enter the startup menu, select the all programs tab, and then select Gene Tracker from the program list. The main screen of Gene Tracker should then be visible as shown Figure 1.
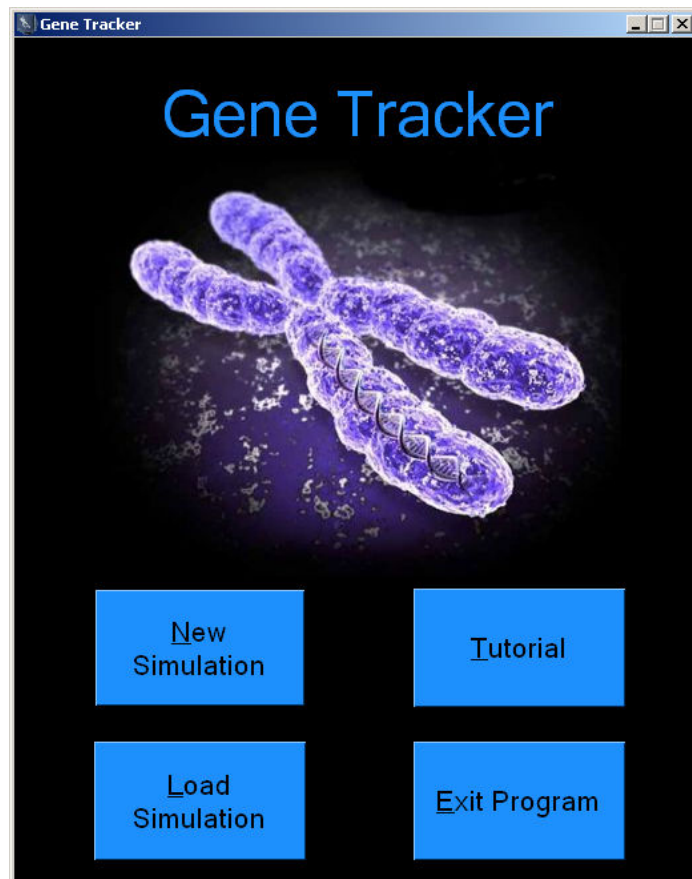

Figure 1: Gene Tracker Main Form

On the main screen the user will see several buttons. One of these buttons will be labeled new simulation. The user selects this option and a new page will appear for the user to enter simulation criteria. The user will enter in the desired parameters and variables for the simulation, and then press the simulate button. After pressing the simulate button, the program will begin to calculate results. After the program has finished calculating the results, the user will be shown a view results page. On this page the user will be able to view several charts and graphs generated from the simulation results. First time users are recommended to run the Tutorial.

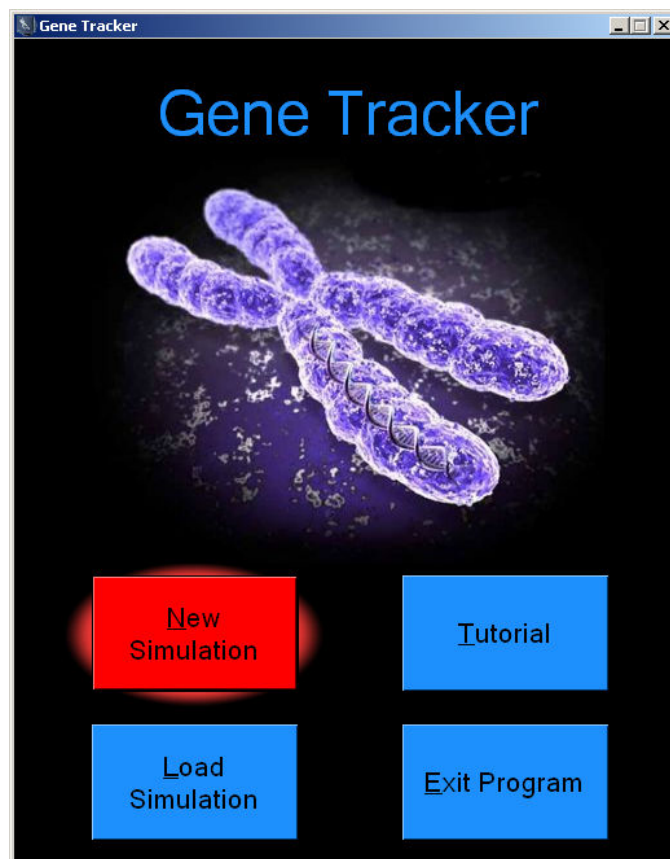### Step 1: Click the New Simulation button

Figure 2: New Simulation Highlighted

The Simulation Parameters Page Figure 3, is where you set up the required data to run a new simulation, the default values are loaded. Select the parameters you want simulated and then press the Simulate button.

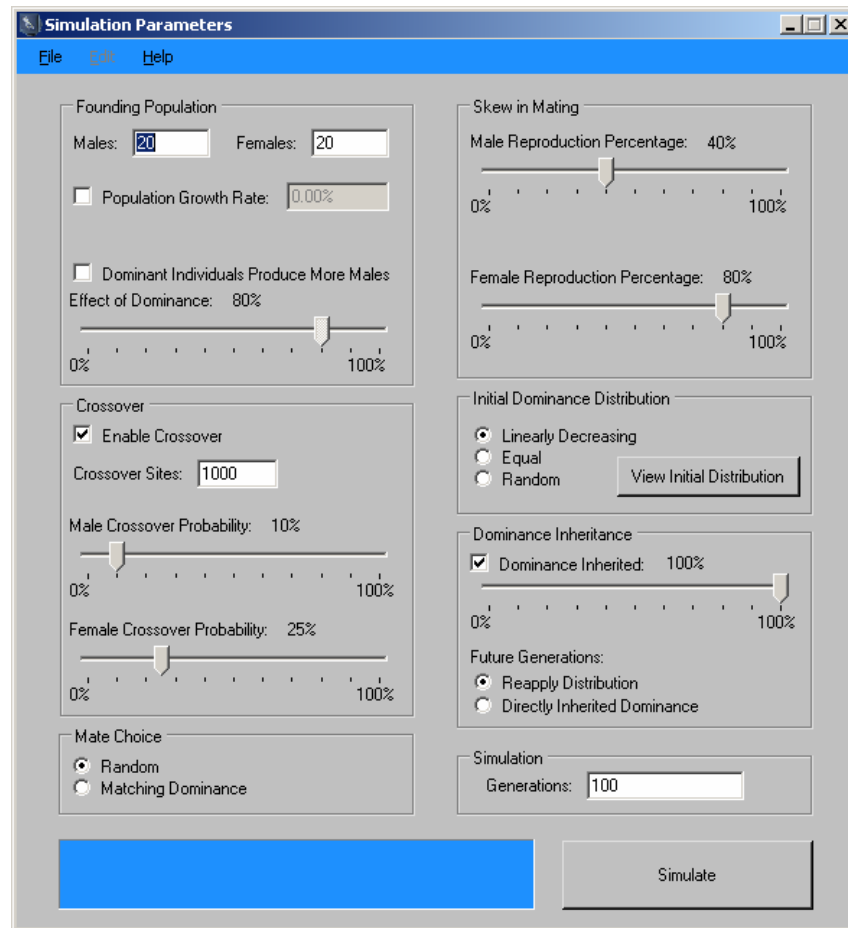## Step 2: Enter the parameters that you want to simulate

Figure 3: The Simulation Parameters Setup Page

Steps:

1. **Founding Population**: The default setting is set to 20 males and 20 females. In this part the user able to select the number of males and females they want for the founding population. Next, for the Population Growth rate they get to select how large they would like to see a population grow, otherwise the population will stay at the default value of the initial population.

2. **Crossover**: The default setting is enabled. The user can then select how many crossover sites for each gene. The user can then select the percentage for male crossover probability and female crossover probability.

3. **Mate Choice**: The user will have the option to select whether the mate choice is random or if it has matching dominance, as in dominate male mating with dominate female.

4. **Skew in Mating**: The user will be able to change the percentages for male reproduction and female reproduction.

5. **Initial Dominance Distribution**: There are three choices that the user will have, the first and also the default setting is triangular. The other options are equal and random. The initial distribution view in Figure 4 below, will tell the number of children assigned to the initial population.

	Male Founders' Children	Female Founders' Children
▶ 0	8	4
1	8	4
2	6	4
3	6	4
4	4	3
5	4	3
6	2	3
7	2	3
8		2
9		2
11		2
1·		2
1:		1
1:		1
1·		1
1!		1

Figure 4: View of initial distribution

6. **Dominance Inheritance**: The default setting is set to enable. If the user does not want this to be enabled click the box with the check mark. You can set the percentage of how much dominance is inherited by future generations. The user can also select reapply distribution or directly inherited dominance, for future generations.

7. **Simulation**: The default setting is set to one hundred generations, enter the amount of generations you would like to be simulated

8. **Last step**: Click on the simulate button and go to view results to see what to do next.

Running a Tutorial Wizard

Novice users will be able to go through a wizard tutorial mode that will walk them through a basic simulation as shown in Figure 5. This walkthrough will take the user to the input parameters page where it will provide a detailed description of each input. It will then show the user the results and explain them to the user.
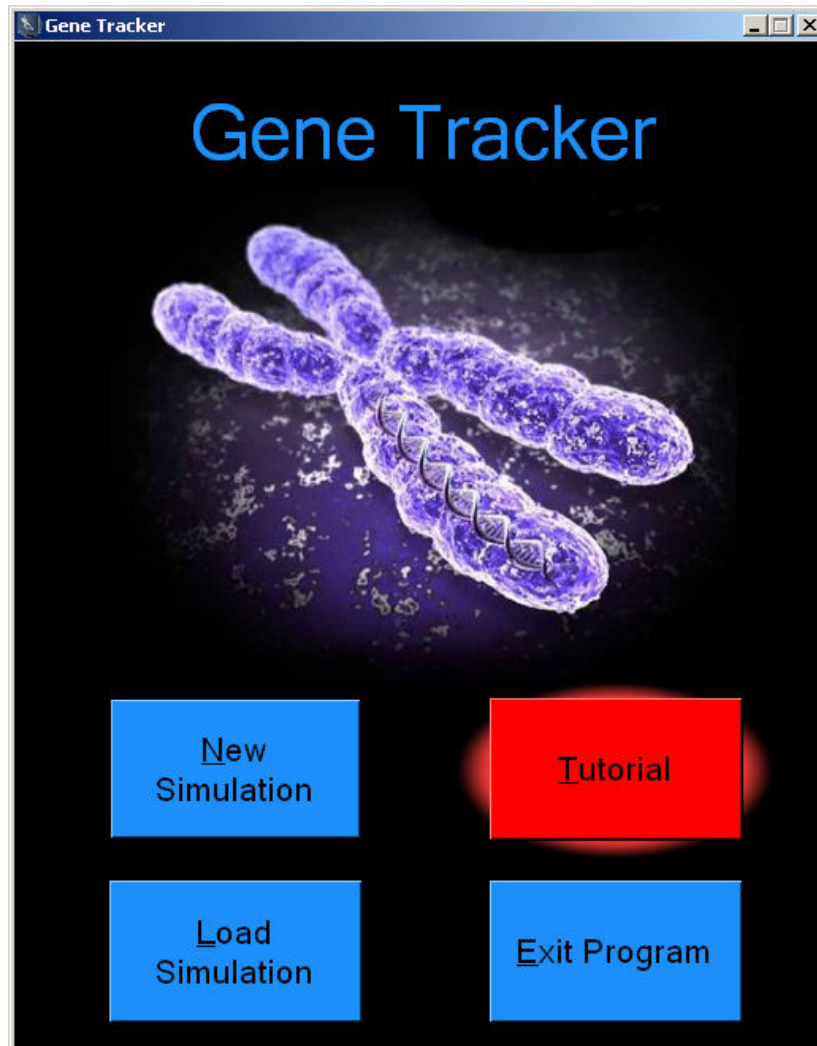

Figure 5: Gene Tracker main view with Tutorial highlighted

Founding Population

After selecting tutorial from the main page, the founding population page will appear as shown below in Figure 6. Here the user will find detailed descriptions of the input parameters for the founding population and the simulation length. When the user is done they press next section.

Figure 6: Tutorial Founding Population Screen

Crossover

The tutorial crossover page shown in Figure 7, contains information on the properties of gene crossover. After the user has read the descriptions for these input parameters, they may click the next section button to move to the next page.
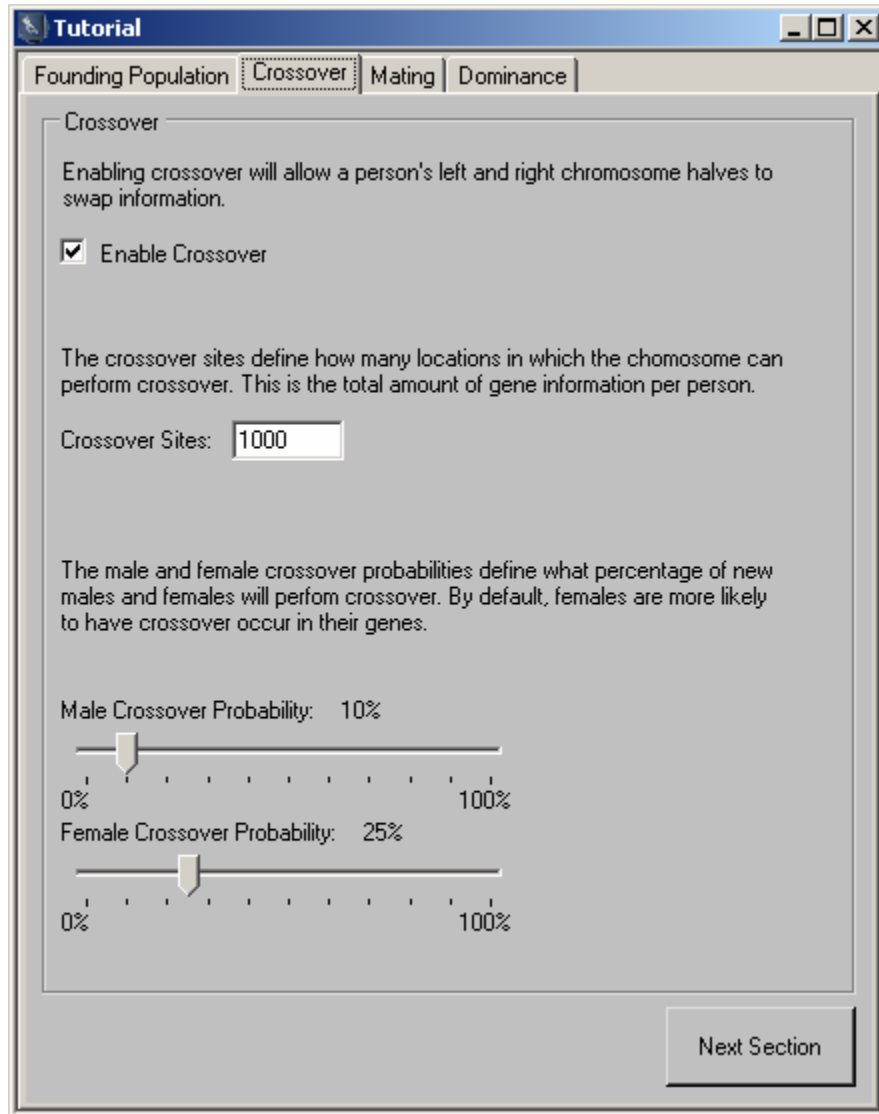

Figure 7: Tutorial Crossover Screen

Mating

The Tutorial Mating Choice page, in Figure 8, provides an explanation of the mating choice input parameters and information on the mating skew. After reading this screen the user can press next section and then be taken to the tutorial dominance page.
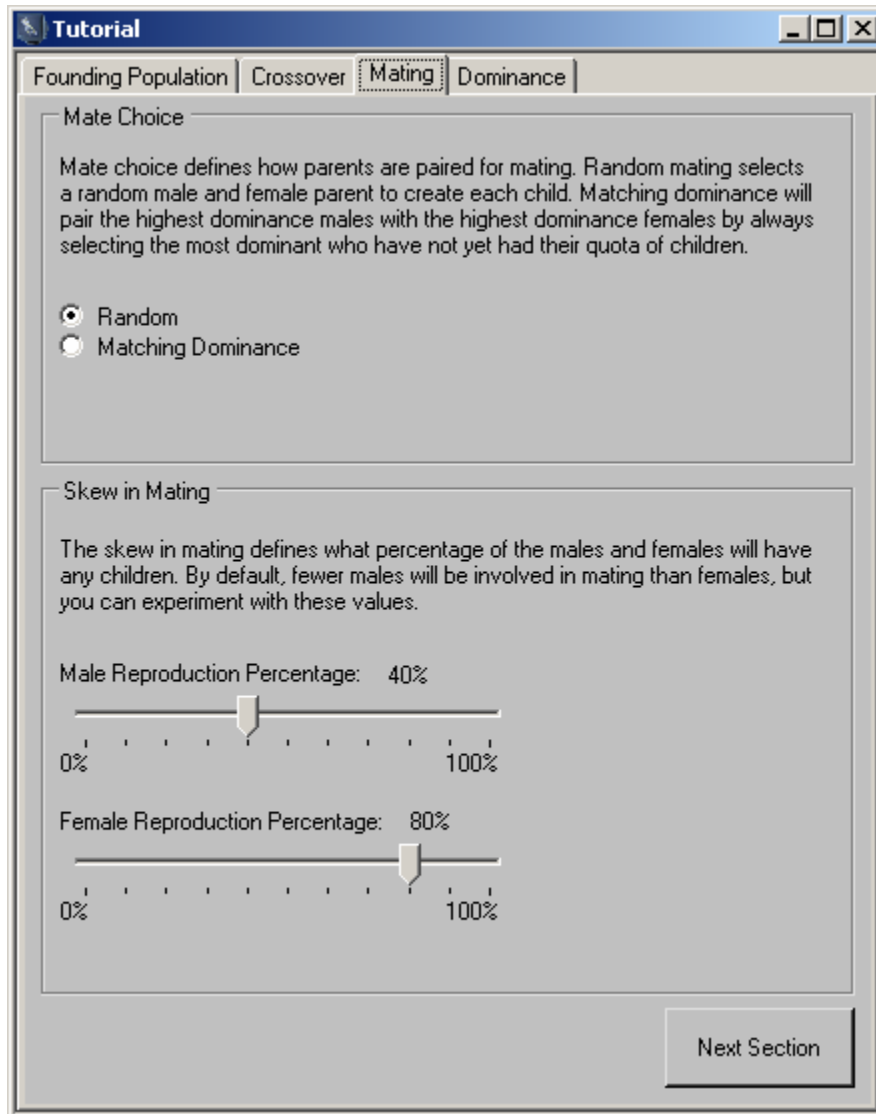

Figure 8: Tutorial Mating Page

Dominance

The Tutorial Dominance Selection page in Figure 9, provides an explanation of the initial dominance distribution parameters and information on the dominance inheritance. After reading this screen the user can press next section and then be taken to the tutorial dominance page.
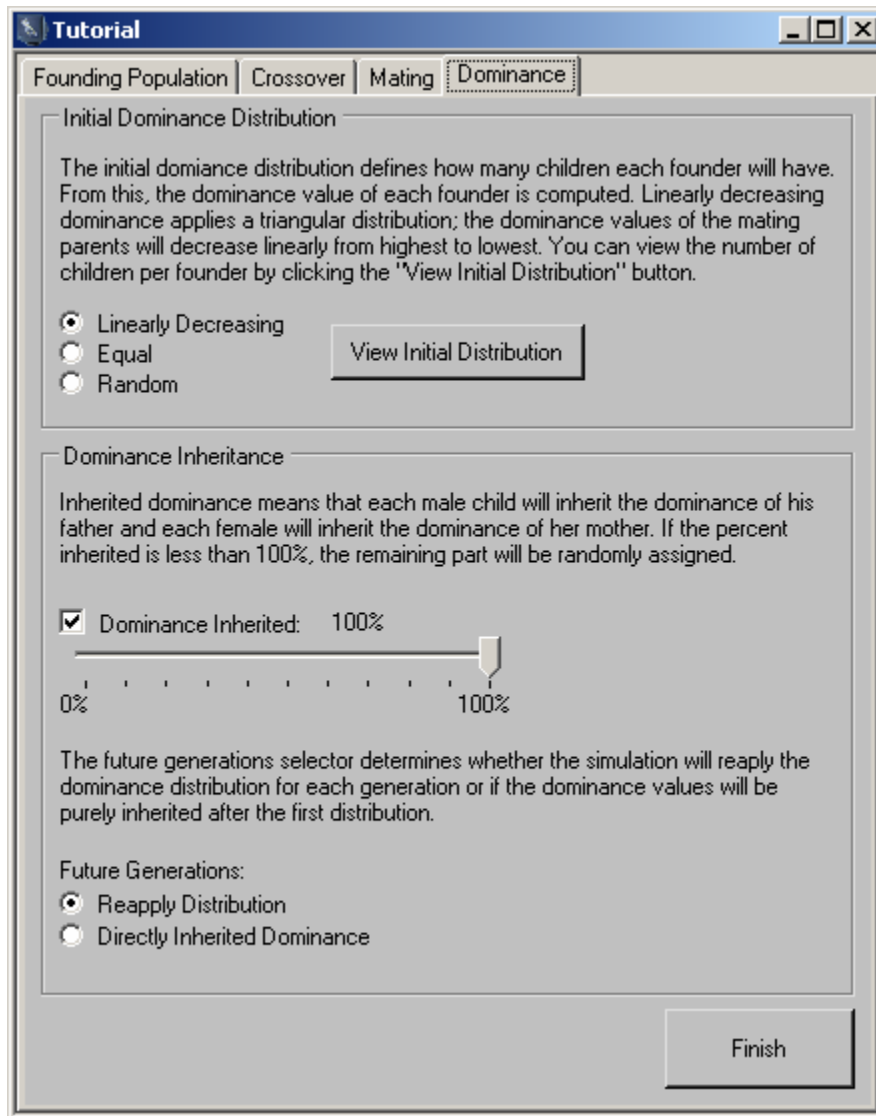

Figure 9: Dominance Selection Page

On the main screen the user will see a button for loading a saved simulation. When the user presses this button, an open dialog box will popup, and the user will then find the file they wish to open, and press the open key. This will load a simulation that has already been run and will recall all the input parameters and result outputs.
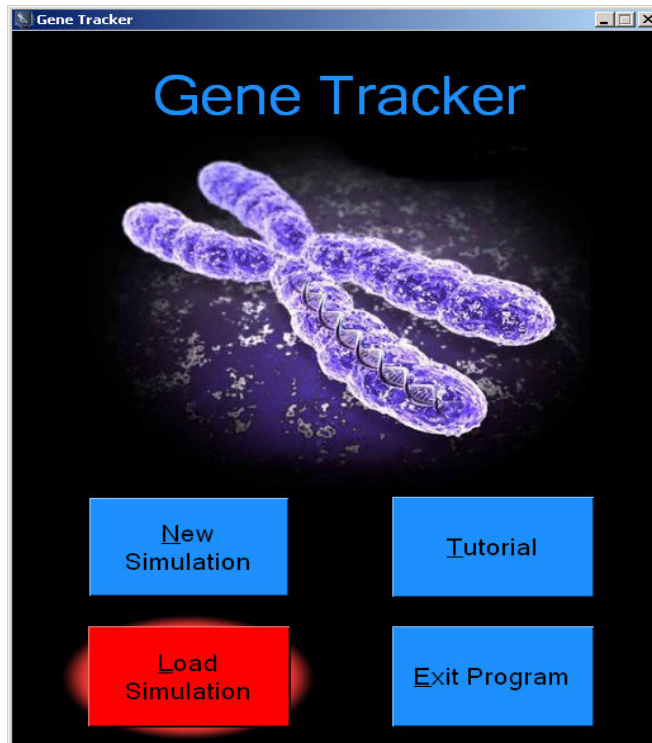

Figure 12: The Load Simulation is highlighted.

In Figure 13, below, shows the window that the user will be able to select a Gene Tracker file to load. The extension will be **.gt** for Gene Tracker saved simulations.
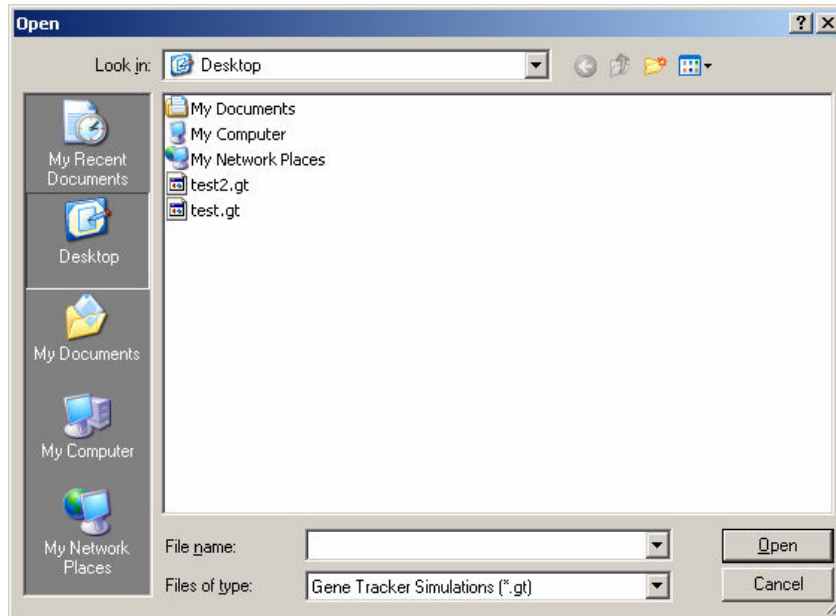
Figure 13: Opening a previous saved simulation

Use the mouse to highlight a file to load then click on the open button to load a previous simulated Gene Tracker data to view the simulation results.

Saving a Simulation

To save a simulation that is user generated, the user must have already run a simulation with Gene Tracker. In Figure 13, we have the Simulation Results page where you need to save your simulation.
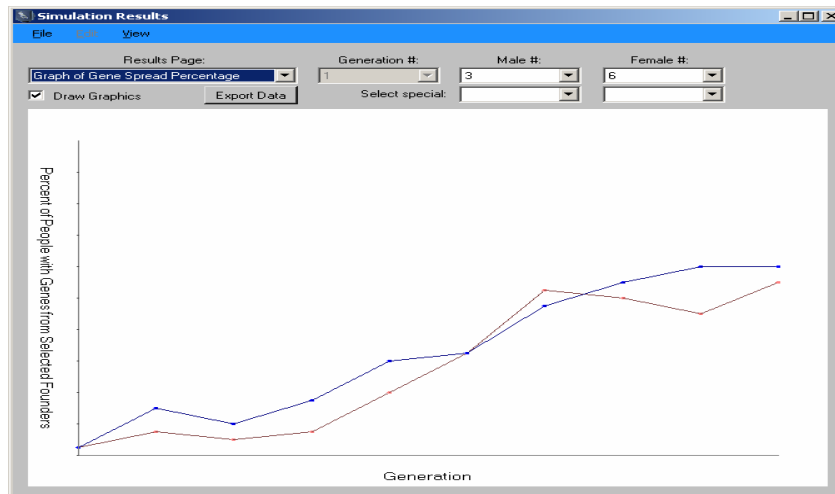

Figure 14: Opening a previous saved simulation

Next select file and go to the save option. The user will see the screen, Figure 15 to save your file. Select the path where you would like to save your simulated data. Click on the save button, after you have named your file.
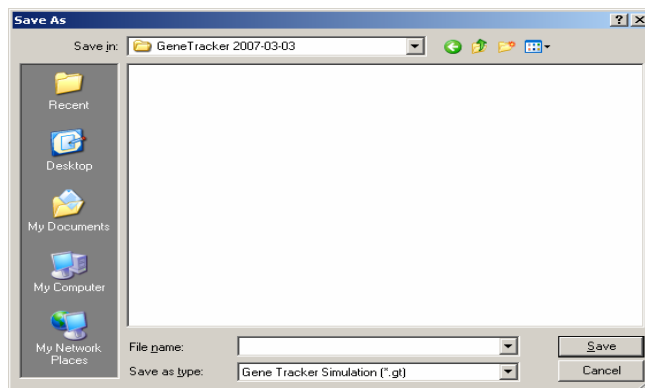

Figure 15: Opening a previous saved simulation

Viewing Simulation Results

After running a simulation, the view simulation results page will appear. In the top left corner of the screen will be a results page drop down box. Clicking on this box will allow the user to select which graph or table they would like to view. Gene Tracker generates six output views: Gene Spread Percentage, Gene Information Percentage, Descendant Percentage, Male:Female Ratio, Chromosome View, and Detailed Results. The default result and first visible results page will be the Graph of Gene Spread Percentage.

Gene Spread Percentage

The Gene Spread Percentage shows the percent of people with any genes from the selected founders across generations. The dropdown boxes labeled Male and Female contain all of the founding males and females. By default, those whose genetic information were most widely spread throughout the simulation are selected. The user may click the dropdown box and view results from any male or female in the founding population. The dropdown boxes labeled "select special" contain options to view most dominant, which displays the most dominate founder, most gene spread, which displays the founder whose genes are most abundant in the final generation, and most gene info, which displays the founder with the most gene information in the final generation.
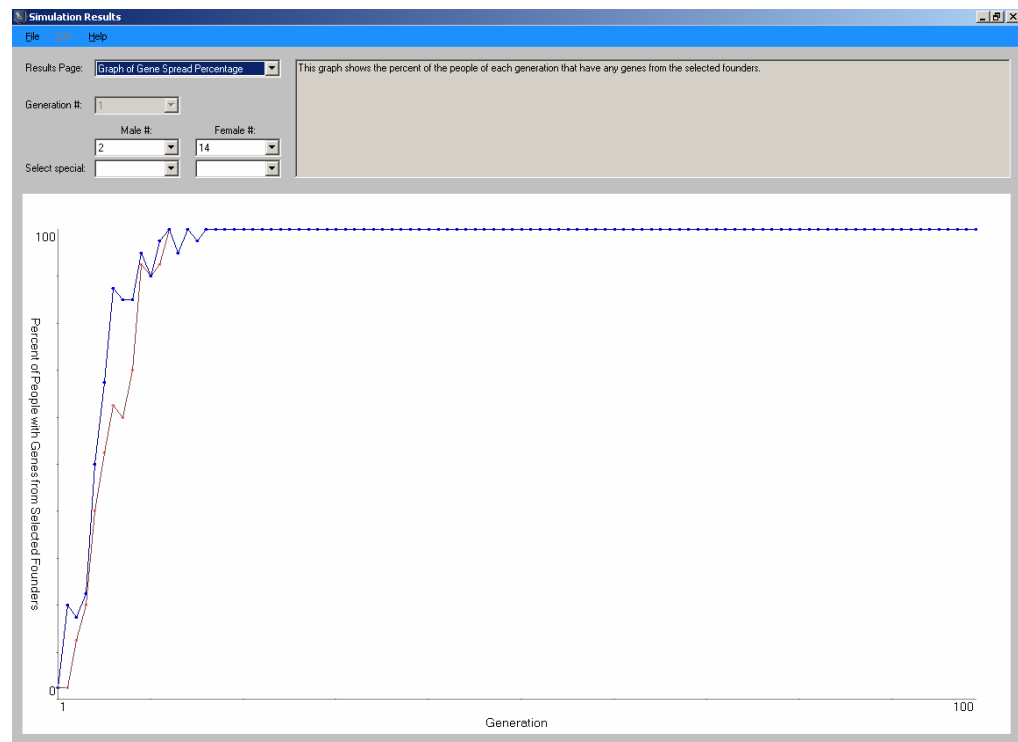

Figure 16 – Graph of Gene Spread Percentage

Gene Information Percentage

Select the results page dropdown box and choose "Graph of Gene Information Percentage". This page shows the percent of genes from the founder that is in the population for each generation. This chart defaults to the male and female with the highest percentage of gene distribution in the current generation, but the user may view the gene percentage of any male or female by clicking on the male or female number box and choosing a person.
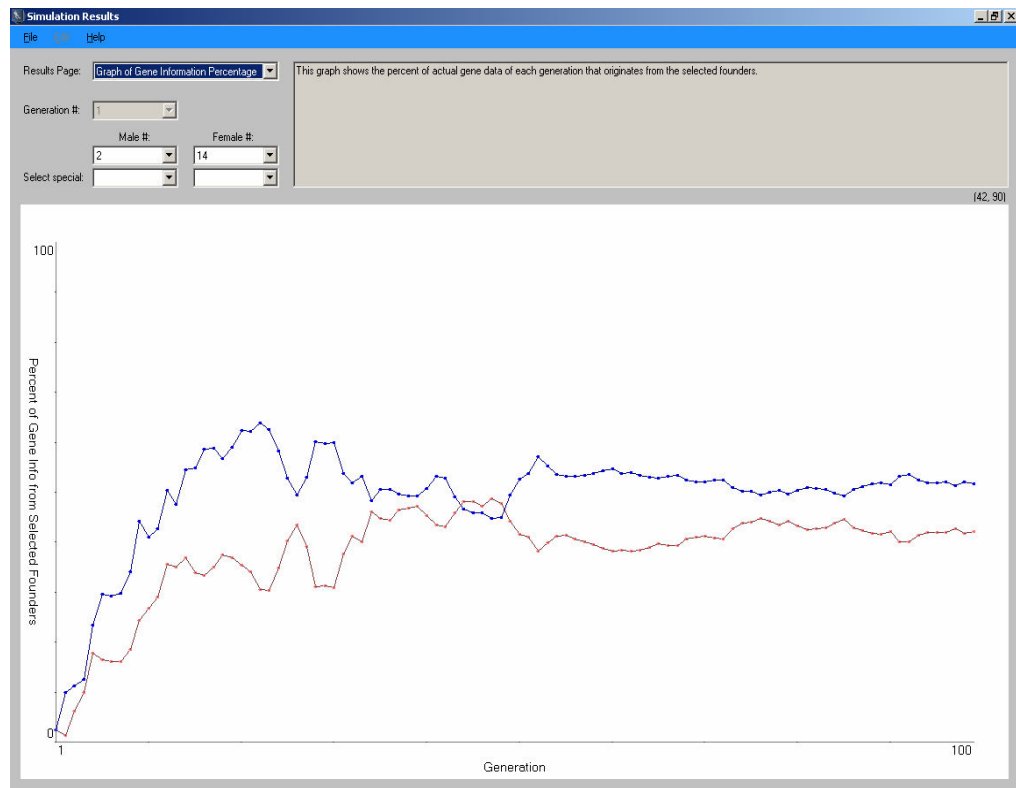

Figure 17- Graph of Gene Information Percentage

16

Descendant Percentage

To view the Graph of Descendant Percentage, on the simulations results page click on the dropdown box labeled results page and select graph of descendant percentage. This graph displays the percentage of individuals that are directly descended from the selected founders in each generation.
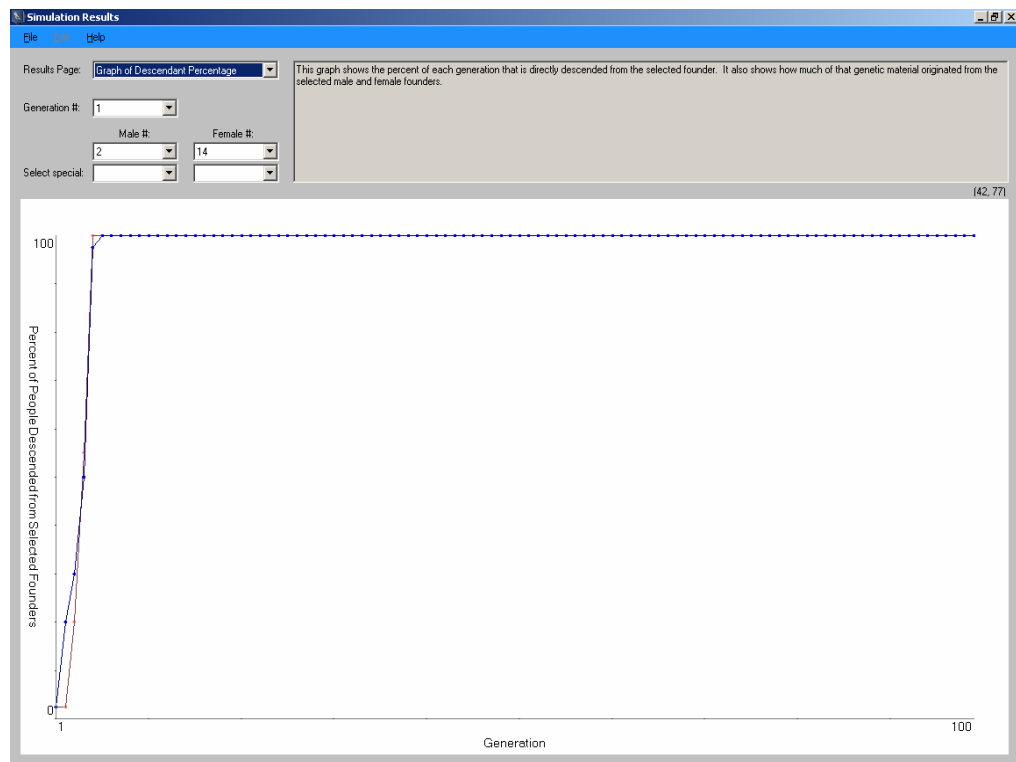

Figure 18 – Descendant Percentage

Male : Female Ratio

The graph of male to female ratio shows the ratio of male founder genes to female founder genes throughout the length of a simulation. This allows the user to see the amount of genes inherited from males compared to the amount of genes inherited from females. The percentage of genes that are from males is displayed in blue, while the percentage of genes from females is displayed in pink.
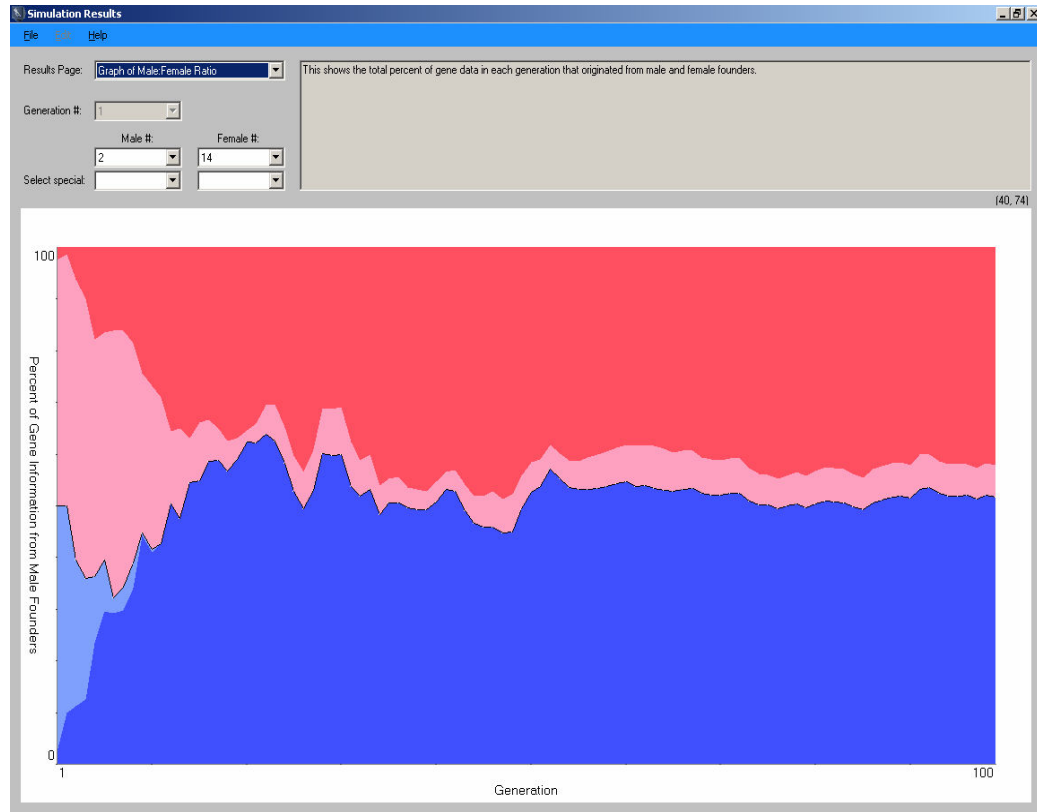

Figure 19 – Graph of Male:Female Ratio

Chromosome View

The chromosome view shows the inherited genetic material of a single person. The user may choose their desired person by selecting a generation number and then a male or female number. After the user selects a person, that person's left and right chromosomes will appear on screen. Light blue sections are those inherited from the most dominant male and pink sections are inherited from the most dominant female. The dark blue and red sections are those inherited from the most gene spread male and female founder, if either is different from the most dominant. The black and grey sections are gene data inherited from other male and female founders, respectively.
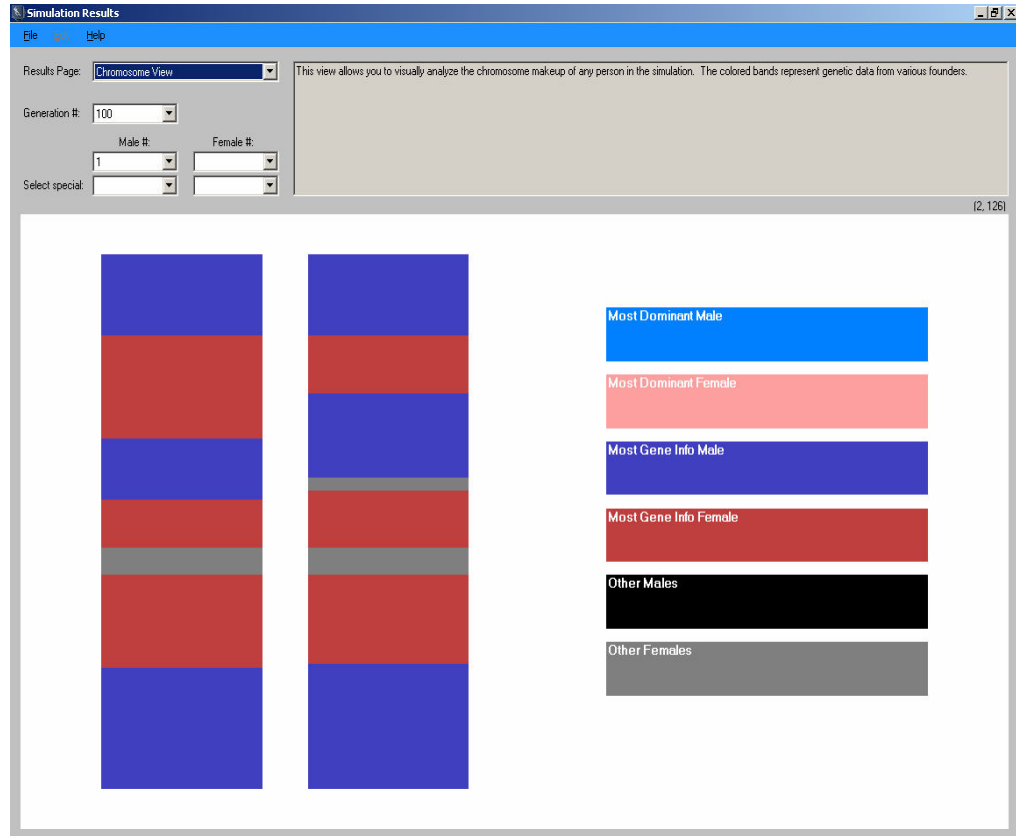

Figure 20 – Chromosome View

Detailed Results

The detailed results page is a detailed listing of every person in the simulation. The user may select a person by choosing a generation and then a female or male. The blue wording next to the labels father and mother show the selected persons father and mother by listing their generation number and male or female number. The boxes below this represent the left and right chromosomes of the selected person. These boxes show what piece of genetic material was inherited from which founder in generation 0, and the size of the genetic material inherited from this person. So the first line "Female 14 – Size 4" indicates that the selected persons left chromosome's first four pieces of genetic material was inherited from Female 14 of the founding population at generation 0.
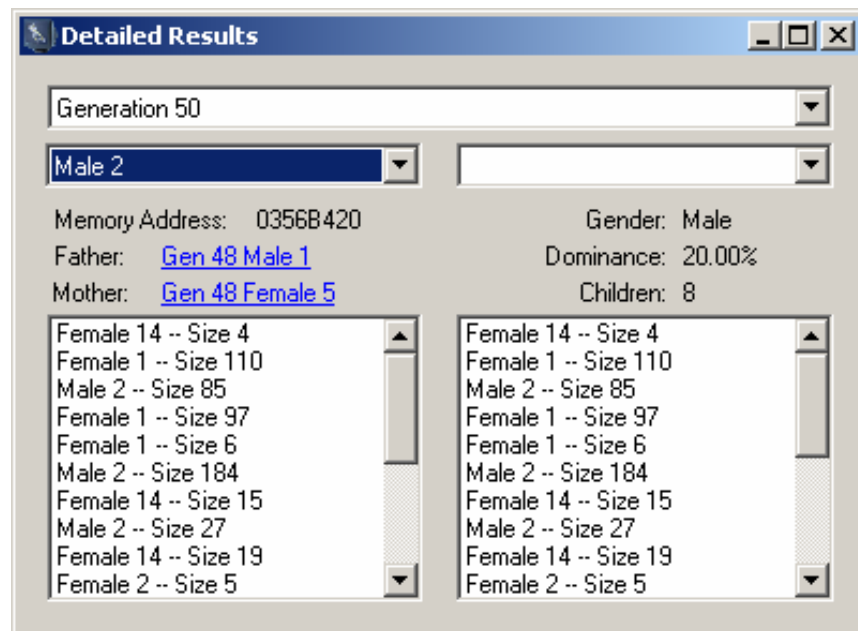
Figure 21 – Detailed Results

Export Simulation Results

To export the results into an excel spreadsheet click the button labeled export data in the simulation results page. A Save As file box will appear with the Save as type set to a Comma-Separated Spreadsheet (*.csv). Enter a name in the file name box and then click the save button. Open a new instance of Microsoft excel and then open the saved file. The data from the simulation should load into the spreadsheet.
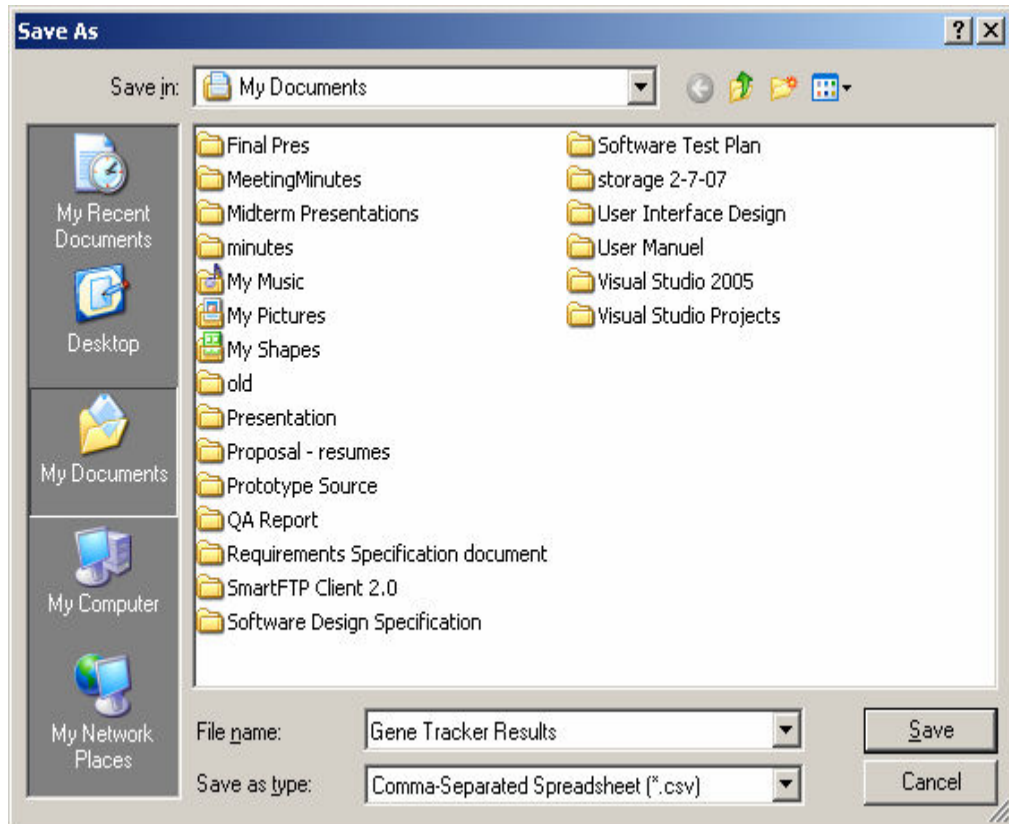

Figure 22- Saving files as a .csv