

Quantitative Life Sciences: an Important Opportunity for Online Education

- Market size

A large number of students are interested in careers in healthcare delivery and biomedical research need foundational training in life sciences.

- Fit with MIT's educational style

Biology subjects at MIT are taught in a problem oriented mode optimally positioned for adaptation to an online format.

- Outreach

We are already using online tools (e.g. StarGenetics) to transfer MIT knowhow to disadvantaged settings.

7.03 (Genetics) is particularly suited for online learning

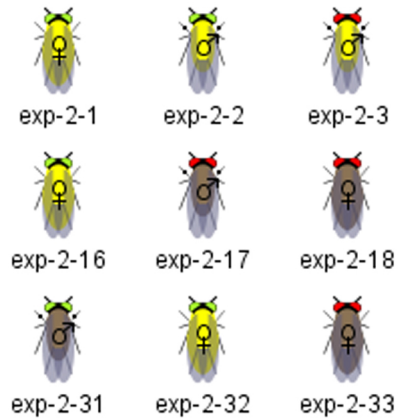
- Entire subject is based on a small set of core principles/concepts
- Course is organized around a set of ~20 canonical problems
- Many of these are unique to our class:
 - Use of genetic simulator to test hypotheses
 - Mutational analysis of regulatory circuits
 - Calculation of LOD scores
 - Human population genetics and GWAS
 - Bioinformatics - sequence comparison and analysis

StarGenetics Simulator

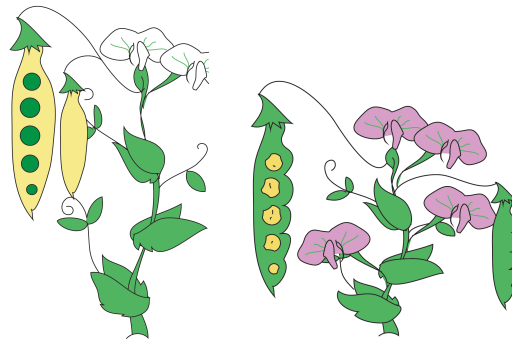
- Teaches students to use genetics as a tool to understand biology by formulating and testing hypotheses
- Teaches students to use probability and statistics calculations to extract maximum information from a limited number of progeny
- Has changed the way the course is organized and concepts are taught to more closely match how actual genetic analysis is done

StarGenetics organisms:

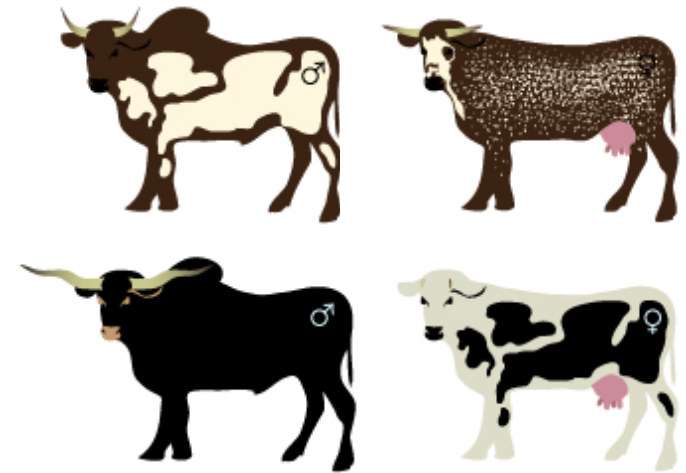
Fruit Flies



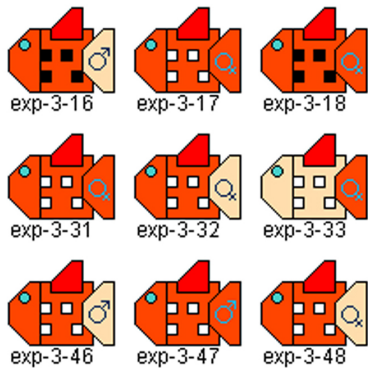
Mendel's Peas



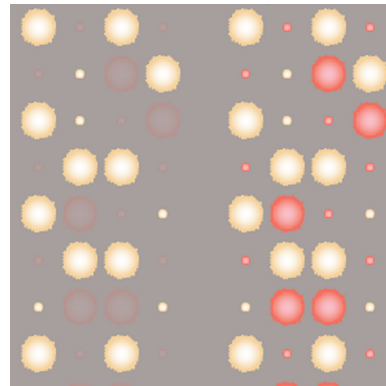
Cows



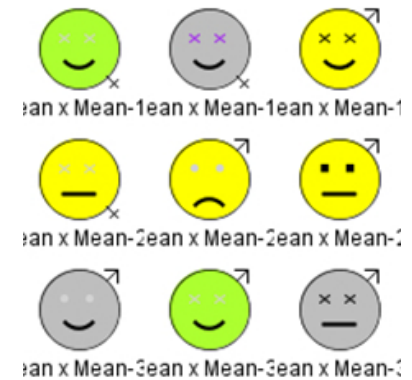
Fish



Yeast



Smileys



StarGenetics: Fly User Interface

Star Genetics – SG Fly WB For Presentation.xls

File Tools Help PRE-RELEASE VERSION

Tools

- Punnett Square
- Send suggestions

Strains

- Mutant 3
- Wildtype M
- Wildtype F

Properties

Name: Wildtype F
Sex: FEMALE
Bodycolor: wildtype
EyeColor: wildtype
Matings: 100
WingSize: wildtype
Notes:

Active Experiment exp-2 Add more matings Save experiment Discard

Individual Sorted Summary

Mating site

- Wildtype F
- Mutant 2

exp-2-1	exp-2-2	exp-2-3	exp-2-4	exp-2-5	exp-2-6	exp-2-7	exp-2-8	exp-2-9	exp-2-10	exp-2-11	exp-2-12
exp-2-13	exp-2-14	exp-2-15	exp-2-16	exp-2-17	exp-2-18	exp-2-19	exp-2-20	exp-2-21	exp-2-22	exp-2-23	exp-2-24
exp-2-25	exp-2-26	exp-2-27	exp-2-28	exp-2-29	exp-2-30	exp-2-31	exp-2-32	exp-2-33	exp-2-34	exp-2-35	exp-2-36
exp-2-37	exp-2-38	exp-2-39	exp-2-40	exp-2-41	exp-2-42	exp-2-43	exp-2-44	exp-2-45	exp-2-46	exp-2-47	exp-2-48

Saved experiments exp-1 Rename Discard

Individual Sorted Summary

Mating site

- Mutant 1
- Wildtype M

exp-1-1	exp-1-2	exp-1-3	exp-1-4	exp-1-5	exp-1-6	exp-1-7	exp-1-8	exp-1-9	exp-1-10	exp-1-11	exp-1-12
exp-1-13	exp-1-14	exp-1-15	exp-1-16	exp-1-17	exp-1-18	exp-1-19	exp-1-20	exp-1-21	exp-1-22	exp-1-23	exp-1-24
exp-1-25	exp-1-26	exp-1-27	exp-1-28	exp-1-29	exp-1-30	exp-1-31	exp-1-32	exp-1-33	exp-1-34	exp-1-35	exp-1-36

StarGenetics: Yeast User Interface

The screenshot displays the StarGenetics software interface for yeast genetics. The window title is "Star Genetics - SG Yeast WB for Presentation.xls" and it includes a "PRE-RELEASE VERSION" badge. The interface is organized into several panels:

- File Tools Help:** Standard menu options.
- Suggestion box:** Contains a "Send suggestions" button.
- Strains:** A vertical list of three yeast strains: Strain 1 (yellow), Strain 2 (red), and Strain 3 (white).
- Active Experiment:** Labeled "exp-1", with buttons for "Add more tetrads", "Save experiment", and "Discard".
- Mating site:** Shows a diagram with Strain 2 (red), Strain 3 (white), and a resulting Diploid (yellow).
- Tetrads:** A 10x3 grid of yeast colonies. The first column is labeled "Tetrads" and the second column is labeled "Complete". The third column is labeled "-Ade YPG".
- Select lawn:** A dropdown menu with options: None, Strain 1, Strain 2, and Strain 3.
- Select media:** A dropdown menu with options: Complete, -Leu, -Ade, YPG, -Ade -Leu, and -Ade YPG.
- Buttons:** "Add" (green plus icon) and "Discard" (red minus icon) buttons are located below the media selection menu.
- Summary:** At the bottom, a table shows "Tetrad type" and "Count" for the selected tetrads.

Tetrad type	Count
Complete	1
-Ade YPG	1

Work stream

People

Funding stream

Software Development	OEIT Vijay Kumar Chuck Shubert Ivan Ceraj	DUE (1.75 FTE)
Problem Development	7.03 Instructors TAs Students	Biology Department
Outreach Workshops Web access Assessment Proposals	HHMI Ed Group Graham Walker Technical Instructors (Aleman, Bumgarner, Brauneis)	HHMI (2 FTE) Davis Foundation (\$250K, 2yr) NSF (\$356K, 3 yr)