

Aipotu: a simulation linking Genetics, Biochemistry, Molecular Biology and Evolution

Pronounced "ay poh too"

Explore connections;
deepen understanding

With Aipotu, your students will explore:

- **Genetics** by crossing organisms to discover alleles and interactions
- **Biochemistry** by designing and folding proteins
- **Molecular Biology** by editing and designing genes
- **Evolution** by subjecting organisms to mutation and selection

Your students will also:

- develop and test *hypotheses*
- construct *scientific arguments*
- *present* and *critique* data

How do the flowers get their colors?
(a dramatization)

Let's see. There are four starting plants.

Let's try self-crossing red.

Ray 1: Red self-cross

1-1	1-4	1-7	1-10	1-13	1-16	1-19	1-22	1-25
1-2	1-5	1-8	1-11	1-14	1-17	1-20	1-23	1-26
1-3	1-6	1-9	1-12	1-15	1-18	1-21	1-24	

Red and white. So the red is heterozygous.

And red must be dominant to white; but why?

Here's what red looks like in Biochemistry.

One allele makes a red protein.

The other makes no protein! That must be why white is recessive.

Why does the white allele make no protein?

Here it is in Molecular Biology.

The white allele doesn't make any mRNA or protein. I wonder what's wrong?

Oh look, the mutation is in the promoter.

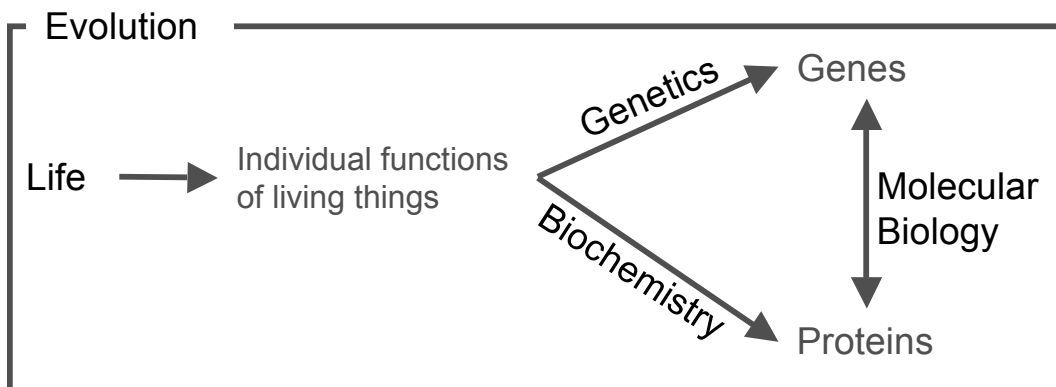
Now let's see if we can evolve new colors.

Wow! It took a while, but there are greens!

OK. I'll load the field with reds and set to select for green. Here goes...

Let's bring them into Genetics and see what's going on.

Aipotu Connects the Major Disciplines of Biology in an Interactive Simulation



- Life can be explained in terms of The Individual Functions of Living Things.
 - in this case, the color of Aipotian flowers
 - *with the goal of producing a pure-breeding purple flower*
- Genetics explains The Individual Functions of Living Things in terms of Genes.
 - here, students can cross flowers and observe the offspring to find:
 - which alleles are present
 - how they interact
 - *to show their understanding, they construct a purple flower*
- Biochemistry explains The Individual Functions of Living Things in terms of Proteins.
 - here, students edit and design proteins that are folded by the software to find:
 - the relationship between structure and color
 - how the structures of the proteins produced by each allele differ
 - *to show their understanding, they construct a purple protein*
- Molecular Biology connects Genetics and Biochemistry by explaining how Genes encode Proteins.
 - here, students edit and design genes that are expressed by the software to find:
 - the relationship between gene and protein
 - how the DNA sequences of the alleles differ
 - *to show their understanding, they construct a pure-breeding purple flower*
 - *they then test this flower in Genetics to show that it is pure-breeding*
- Evolution provides a context that explains how these features changed over time to become what they are.
 - here, students subject fields of flowers to mutation and selection to find:
 - basic evolutionary principles such as selection, mutation, variation, etc.
 - *any interesting organisms can be examined using the tools in Genetics, Biochemistry, etc.*

Aipotu is widely-used and well-tested:

- used with over 1000 college students since 2007
- used in colleges and high schools
- used in US and internationally

Aipotu is free and open-source:

- download from <http://intro.bio.umb.edu/aipotu/>
- lab manuals and other materials free on-line
- documentation also on-line
- written by Brian White (brian.white@umb.edu)