

# Introduction - Avida-ED and Digital Evolution

*This file contains the discussion questions for the Avida-ED Introduction exercise. Please refer to the Avida-ED Lab Manual for complete instructions.*

## Part I: Examining an Avidian Individual and Observing Replication

- At which position of the Avidian “genome” does the program begin reading the instructions?

*The code starts reading at position 1 “w”*

- At which positions of the “genome” are the instructions for replication?

*The instructions for replication are at position 43 “v”*

Mutations in the offspring appear as an instruction with a black circle. Record the mutations for a single round of replication.

Position	1	10	20	30	40	50												
Ancestor	w	z	c	a	g	.....z	v	f	c	a	x	g	a	b				
Mutations	w	z	c	v	g	.....c	u	.....i	.....c	.....z	v	f	c	a	x	g	a	b

Total # of mutated sites 3

Locations of mutated sites 4, 12, 29

- If a mutation occurred within the sequence of replication instructions what do you think would happen to that mutated offspring’s ability to replicate?

*Most likely, it would ruin the offspring's ability to reproduce. In perhaps rarer scenarios, it would reproduce, but in a completely different manner.*

- If you wanted to determine the function of each letter (command) of the code, where would you find that information?

*In the details tab in the workbench (next to settings), under instruction details*

- How does the offspring Avidian compare to its parent? In other words, how many differences are there in the set of 50 commands, and where are the differences located in the “genome”?

*It is the same except for 3 commands, one of which is located in the reproductive function, with the other two being located in the n-op c section*

- How is the instruction set (“genome”) for an Avidian similar to a bacterial genome?

*A bacterial genome also has a section with instructions on how to reproduce itself, in that it starts reproduction until it is signaled to stop.*

## **Part II: Observing the Frequency and Location of Mutations that Occur During Replication**

- There are 50 commands. How many sites do you expect will have a mutation given a 2% per site mutation rate?

*1 mutation*

- How does your replicated offspring compare to the parent?

*It's reproductive function is untouched, because no mutation occurred within the reproductive instructions. Only one “q” instruction exists at position*

- How did your offspring (replicated with the 2% mutation rate) compare to your neighbor's offspring (also replicated with a 2% mutation rate)? Did they have the same number and/or type of mutations?

*They replicated at around the same rate, and had about the same number of mutations.*

## **Part III: Evolving a Population**

- What do biologists mean when they use the word “fitness”? How is fitness measured in Avida-ED?

*Biologists use fitness as a quantitative measure of reproductive success of a species over time. Avida-Ed defines it as metabolic rate divided by gestation time*

- Choose two Avidians in your population with different fitness and explain how differences in these Avidians contribute to differences in their fitness.

*One of my Avidians had mutated in such a way that the Avidian had no instruction to copy any of its genetic code, and instead kept reading the chain forever. This had bad fitness because it could not reproduce.*

*Comparing this to an Avidian which did not mutate from the original Avidian in such a way that harmed its reproductive ability, the fitness is much greater.*

- Based on what you observed in the Population Statistics and the Organism Type boxes during the run, what do you think accounts for changes in individual fitness and changes in the average fitness in the population?

*Organisms with low fitness dying, organisms with high fitness reproducing, and mutation.*