

Cycle 12: Experimental Evolution

Video 1:

1. characteristics of model systems that can be used for experimental evolution

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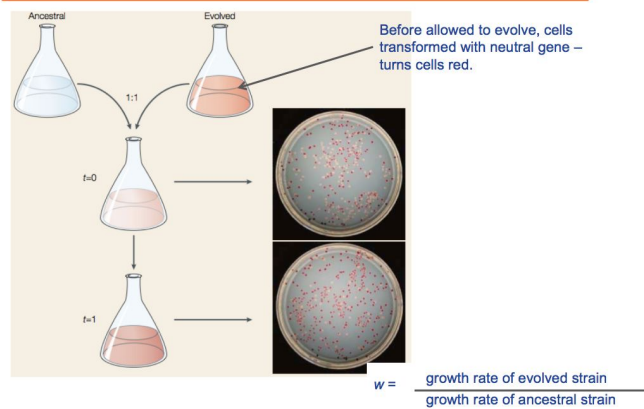
2. Measuring relative fitness in *E. coli*.

- We measure the growth rate of the evolved strand by dividing it by the growth rate of the ancestral strain
- $W = E/A$

3. Assess what it means for W to be $<$, $>$ or $=$ to 1

- W is the relative fitness
 - When $w = 1$ than there is no adaptation
 - $W > 1$ means there is an adaptation
 - $W < 1$ Maladaptation- the relative fitness of the ancestral strand is higher than the evolved

Comparing ancestral and evolved strains



Video 2:

1. design of Lenski's long term evolutionary experiment (LEE) with *E. coli*

- The most famous experiment done so far that tries to identify beneficial mutations that result in adaptation over years
 - Used bacterium *e coli*
 - They were asexual (no recombination)
 - Spontaneous mutation
 - The population size was huge

2. The need to subculture every day

- They were grown in erlenmeyer flasks and eventually would run out of the nutrients to grow
 - Therefore subculture needed to happen everyday to transfer 100u L to a new medium and then subculture that class every day

3. value of freezing samples at -80°C .

- Another important thing, they were able to go back in time to look at the genome by freezing a sample at -80 degrees
 - Have a genotypic snapshot to compare

4. Where citrate enters metabolism (not explicitly mentioned in video).

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5. role of glucose limitation in the experiment and the role of citrate.

- How can the S3 have more cells??? The hypothesis was:
 - Citrate is also a reduced carbon so you can oxidize it
- The reason citrate is in the environment is that it is used to keep iron in the form for it to be taken up by the cells (therefore it not there for growth)
 - The citrate transporter is only expressed under anaerobic conditions- but the cells are in lots of oxygen
- But the **ecological opportunity** that if the cell was able to take up the citrate

6. What is the Cit+ phenotype...that is what did the researchers detect that was different in the Ara-3 line?

- Essential there was a change in the Ara-3 line that made it different than the others
 - Whatever happened must have been rare after 30.000 generations
- The phenotype of being able to grow was called the city phenotype are they were able to use the citrate

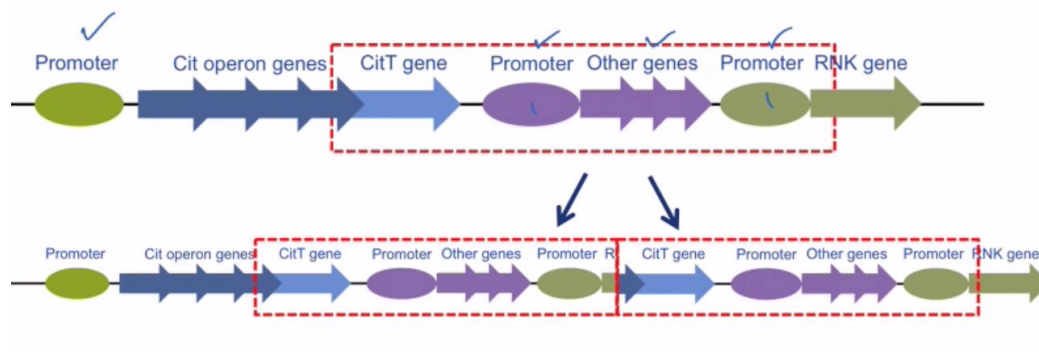
7. Genetic change in the Ara-3 line that gave rise to the Cit+ phenotype (Actualization)

- When a mutation occurs that actual produced a trait
 - At some point a mutation occurs to allow citrate to be taken up under high oxygen environment
- We called this refinement- an improvement upon the initial cit+ phenotype

8. Genetic change that gave rise to refinement of the Cit+ phenotype.

- What actually happen in the city?
 - The operons and controlled by a single promoter
 - Oxygen was the negative regulator ro stop transcription
- Using DNA sequencing there were able to see the city in which showed:

• Duplication of portion of genome



- Found a gene duplication of the gene nearby (upstream of the cit gene) and was inserted downstream

9. What is meant by the term potentiation and what is the evidence that a potentiation event occurred after 20,000 generations?

- Was there A potentiation mutation - that made it possible for actualization to take place
 - After 20.000 the likelihood of cit+ went up

- Tells us that something must have occurred in the window, but before then every experiment there was no change in the genetic background

10. Is the Ara-3 line a new species.

- No all of the relay experiment did the exact same thing, the actual piece of DNA/ insertion is not exactly the same though
- There are many

11. why Cit+ lines do not drive Cit- lines to extinction.

- Overtime kit+ cells can begin to dominate but there is always a small cit- will always be present, not driving it to extinction
- The reason for this, for the first 8 hours the cit- cells are higher than the kit+ cells - allowing them to stay