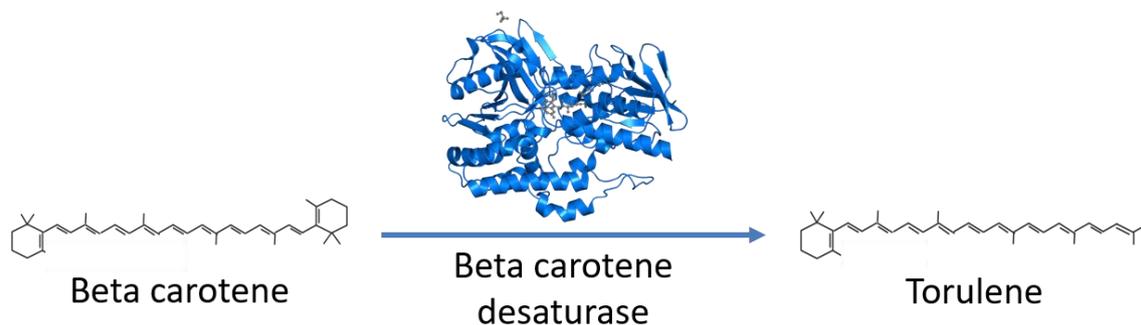


Record sheet: The pea aphid evolution game

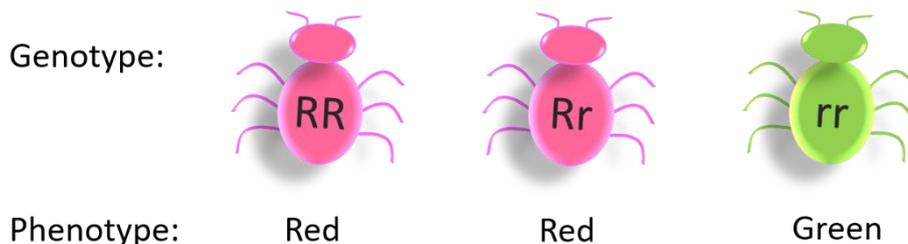
The trait under investigation in this game is pea aphid body colour. The dominant phenotype for this trait is red body colour. Pea aphids are red in colour when they produce a carotenoid molecule called torulene. To produce this molecule they must produce functioning beta carotene desaturase.



If they cannot produce any functioning beta carotene desaturase then they cannot produce torulene and they are green in colour. Green body colour is the recessive phenotype.

Alleles: R codes for functioning beta carotene desaturase

r codes for faulty beta carotene desaturase



A change in the frequencies of alleles in a population indicates the population is evolving.

As you progress through this course you will explore the impact of random events and environmental selection pressures on small populations of pea aphids. This record sheet provides you with tables to help you track alleles in the population over a number of generations. You will use this information to investigate the impact of different mechanisms on the evolution of a population.

Allele frequency: the number of times a particular allele appears in a population as a proportion of the total number of alleles for that particular gene.

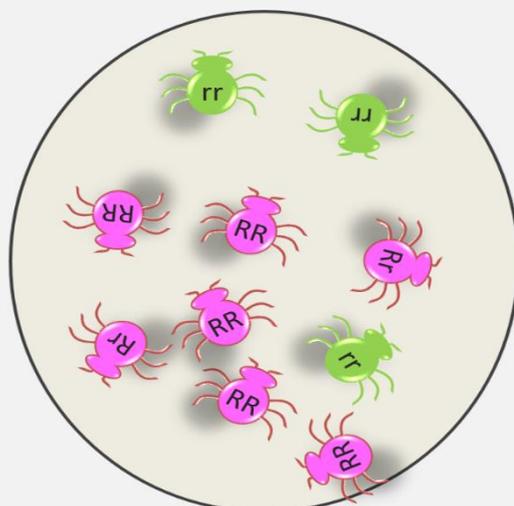
In the population on the right there are 10 aphids. Each aphid has 2 alleles for the beta carotene desaturase gene. So the total number of alleles for this gene in this population is 20.

Count up the alleles for the dominant phenotype. We have 12 in total.

There are 8 alleles for the recessive phenotype. We can calculate allele frequencies for each as:

Frequency of R allele: $12/20 = 0.6$

Frequency of r allele: $8/20 = 0.4$



Track allele frequencies over generations by counting the number of each genotype in the population of 20 aphids at the beginning of each generation. Use this number to calculate the frequency of each allele for each generation.

Game 1: Genetic drift

Table 1: Record of 4 generations of random predation and mating

Generation	Genotype frequency			Total each allele		Total alleles	Allele frequency	
	RR	Rr	rr	R	r		R	r
1	19	1	0	39	1	40	0.975	0.025
2						40		
3						40		
4						40		

Game 2: Selection pressure: Red aphids are not camouflaged from predator

Table 2: Record of 4 generations

Generation	Genotype frequency			Total each allele		Total alleles	Allele frequency	
	RR	Rr	rr	R	r		R	r
1	5	10	5	20	20	40	0.5	0.5
2						40		
3						40		
4						40		

Game 3: Selection pressure changes: Green aphids are not camouflaged from predator

Table 3: Record of 4 generations (put results for generation 4 from game 2 in the first row)

Generation	Genotype frequency			Total each allele		Total alleles	Allele frequency	
	RR	Rr	rr	R	r		R	r
4						40		
5						40		
6						40		
7						40		

Game 4: New selection pressure: Camouflaged green aphids are parasitised by a wasp

Table 4: Record of 4 generations

Generation	Genotype frequency			Total each allele		Total alleles	Allele frequency	
	RR	Rr	rr	R	r		R	r
1	5	10	5	20	20	40	0.5	0.5
2						40		
3						40		
4						40		