Answer on Question#46584 - Biology - Other

A biologist studying a population of birds comprised of some individuals with long-tailed and some short-tailed individuals. She is interested in whether a population of birds is randomly mating or if the birds are preferentially mating with their own tail type. In this species tail length is controlled by a single gene with two alleles (T=long, t=short) where the long tail is dominant. To examine this aspect the scientist will use controlled populations of birds and assess the results of the mating that occurs.

Write an appropriate null and alternative hypothesis for this experiment.

Answer:
The phenomenon when mating is not random, and individuals are preferentially mating with their own type is referred to as positive assortative mating. The term "assortative" refers to classifying and selecting characteristics.
In order to understand the effect of non-random mating patterns, it is useful to first examine the results of random mating. As Hardy and Weinberg demonstrated in the early 20th century, the gene pool of a population that is mating randomly and is not subject to any other evolutionary process will not change – it will remain in equilibrium. If mating is entirely random, there will be nine possible mating patterns for a trait that is controlled by two alleles (T and t).

TT X TT	Tt X TT	tt X TT
TT X Tt	Tt X Tt	tt X Tt
TT X tt	Tt X tt	tt X tt

In a population which has 50% of each of these two alleles, the expected offspring genotype frequencies with random mating will be 25% homozygous dominant (TT), 25% homozygous recessive (tt), and 50% heterozygous (Tt), as shown in the table below. They will remain in this ratio every generation that random mating continues and no other evolutionary mechanism is operating.

Possible parent mating patterns	Expected offspring genotypes		
	TT	Tt	tt
TT X TT	4		
TT X Tt	2	2	
TT X tt		4	
Tt X TT	2	2	
Tt X Tt	1	2	1
Tt X tt		2	2
tt X TT		4	
tt X Tt		2	2
tt X tt			4
Total	9 (25%)	18 (50%)	9 (25%)

Positive Assortative Mating
An example of positive assortative selection would be long-tailed birds mating only with long-tailed

birds. Positive assortative mating results in four possible mating patterns with respect to genotypes for traits that are controlled by two autosomal alleles – homozygous dominant with homozygous dominant (TT X TT), homozygous dominant with heterozygous (TT X Tt), heterozygous with heterozygous (Tt X Tt), and homozygous recessive with homozygous recessive (tt X tt).
The net effect of positive assortative mating is a progressive increase in the number of homozygous genotypes (TT and tt) and a corresponding decrease in the number of heterozygous (Tt) ones in a population, as shown in the table below. Each generation that there is positive assortative mating, this polarizing trend will continue in the population.

Positive Assortative Mating			
Possible parent mating patterns	Expected offspring genotypes		
	TT	Tt	tt
TT X TT	4		
TT X Tt	3	1	
Tt X Tt	1	2	1
tt X tt			4
Total	8 (50%)	3 (19%)	5 (31%)

Thus, there will be 69% of long-tailed birds and 31% of short-tailed.

Null hypothesis assumes that there is no difference or correlation. Thus, null hypothesis is that mating is random, i.e. the distribution of offsprings corresponds to random pattern (75% long-tailed, 25% short-tailed).

Null hypothesis: tail type does not affect mating preferences, the distribution of offsprings corresponds to random pattern (75% long-tailed, 25% short-tailed).
Alternative hypothesis: tail type affects mating preferences, the distribution of offsprings does not correspond to random pattern (75% long-tailed, 25% short-tailed).