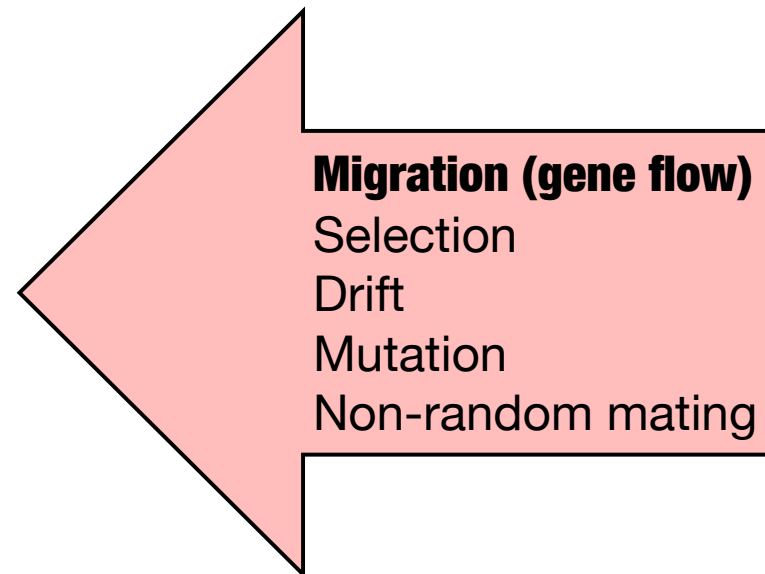
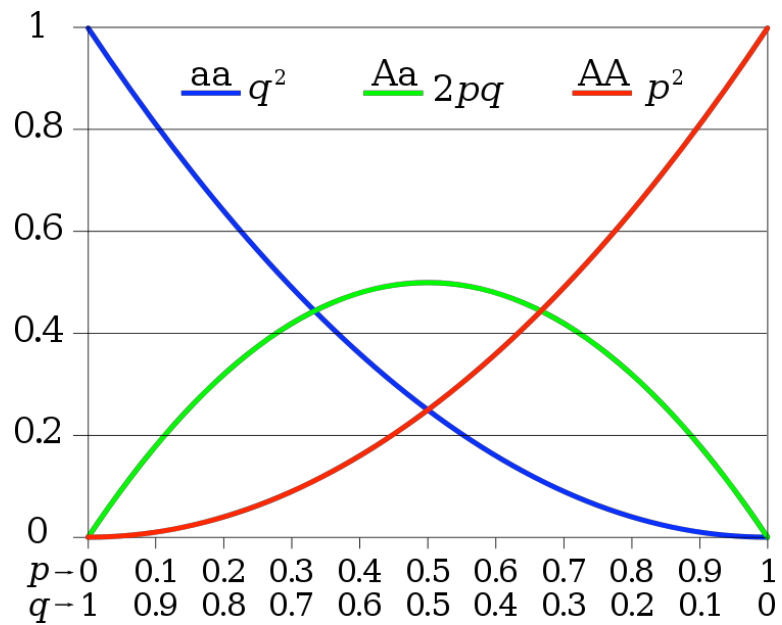
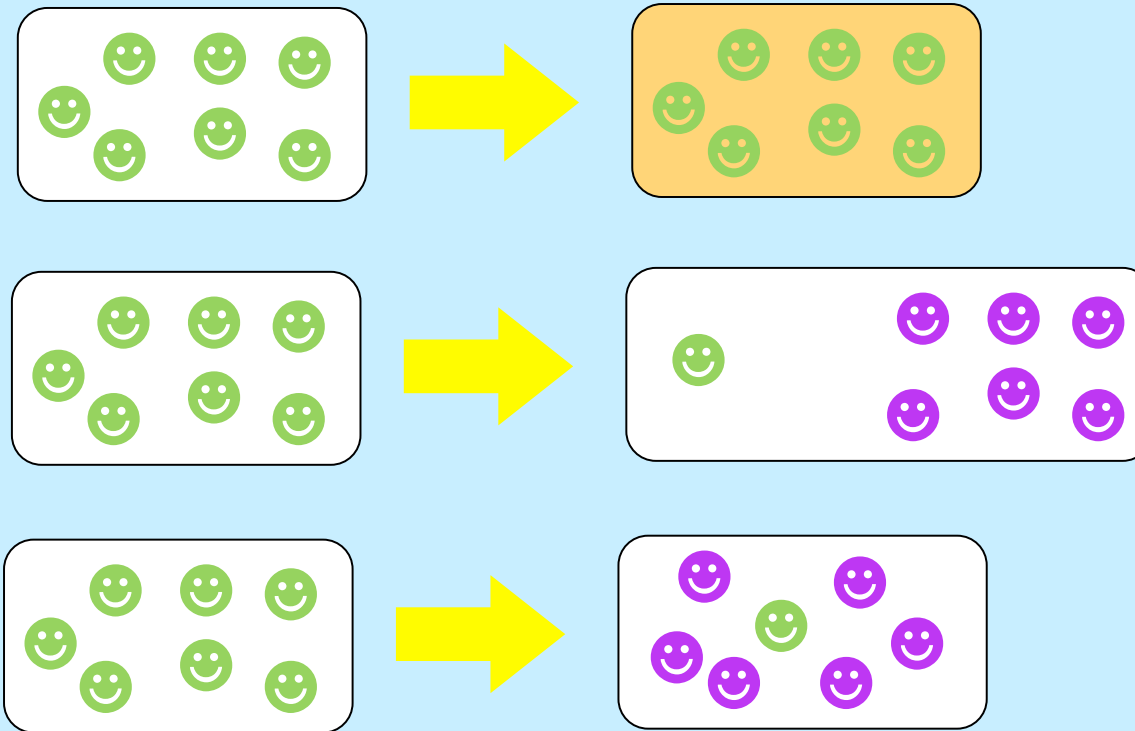


# Migration





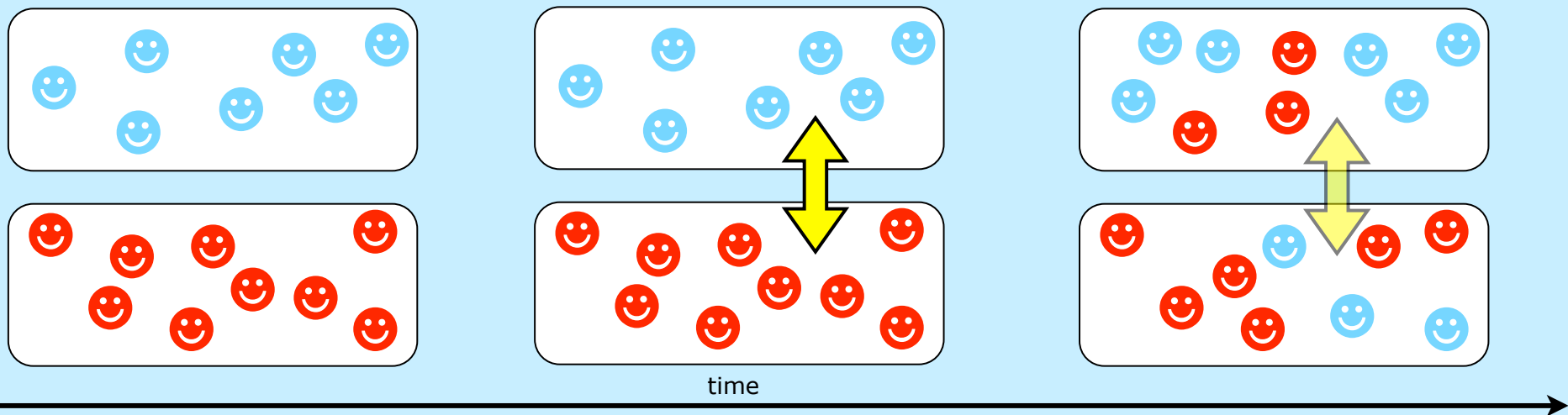
# Migration - Gene flow - Dispersal



... movement between groups that result in **genetic exchange**.

# Migration (Gene flow)

Gene flow—also called migration—is any movement of genes from one population to another. Gene flow includes lots of different kinds of events, such as pollen being blown to a new destination or people moving to new cities or countries. If genes are carried to a population where those genes previously did not exist, **gene flow can be a very important source of genetic variation.**



The amount of gene flow that goes on between populations varies a lot depending on the type of organism. As you would expect, populations of relatively sedentary organisms are more isolated from one another than populations of very mobile organisms.

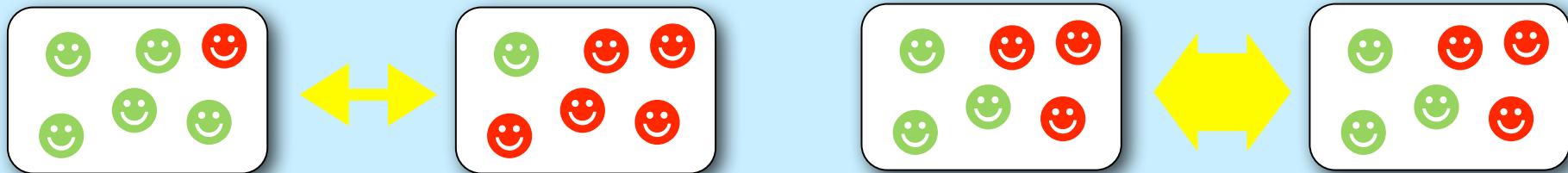
# Migration - Consequences

Gene flow has several important effects on evolution:

Within a population - It can introduce or reintroduce genes to a population, **increasing genetic variation** of that population.



Across populations - By moving genes around, it can make distant populations genetically similar to one another (**decreasing genetic variation**). The more gene flow between two populations, the more likely that two populations will NOT evolve into two species.



The extent of genetic diversity within and between subpopulations can be thought of as a balance between the opposing force of genetic drift, which reduces diversity within populations but increases it between them, and gene flow which brings new genetic diversity into populations but reduces it between them.

# Migration - Consequences

	mtDNA	Y chr	auto	X chr
Expected				
First Nation	1.0	0.0	0.5	0.67
European	0.0	1.0	0.5	0.33
Observed				
First Nation	0.90	0.01	0.16	0.25
European	0.02	0.94	0.79	0.69

Examination of mtDNA indicates that nearly all (90%) of the maternal ancestry in this population is First Nation American. In contrast, Y-chromosome analysis indicates that nearly all (94%) of the paternal ancestry is European.

# Migration - Consequences

$m$ : proportion of migrants (migration rate)

$\Rightarrow (1-m)$ : proportion of **non**migrants

$$p_1 = p_0(1-m) + mp_m$$

alleles that did not migrate      new alleles

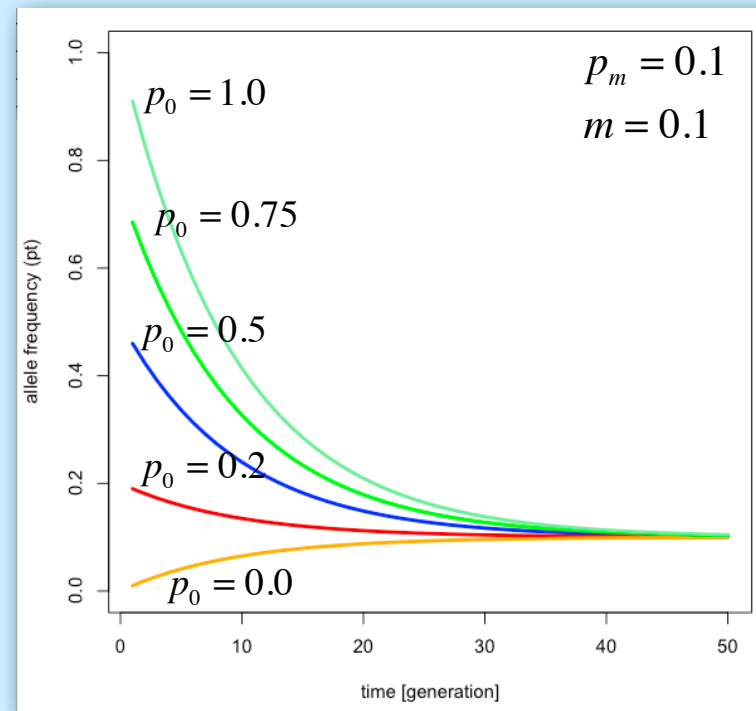
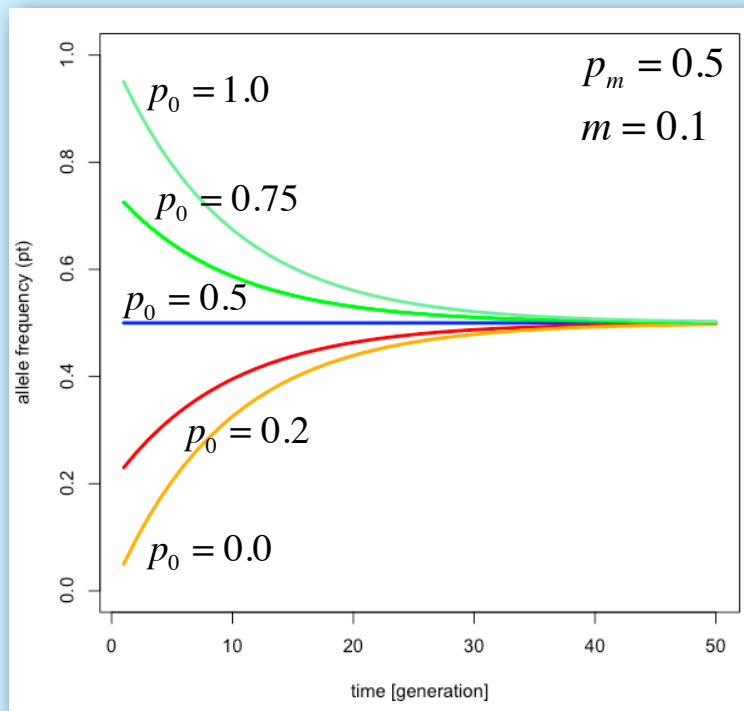
$$\Delta p = p_1 - p_0 = m(p_m - p_0)$$

When the amount of gene flow between groups is high, gene flow has the effect of homogenizing genetic variation over the groups. When gene flow is low, genetic drift, selection, and even mutation in the separate groups may lead to genetic differentiation.

# Migration - Consequences

$$p_1 = p_0(1 - m) + mp_m$$

$$p_t = p_m + (p_0 - p_m)(1 - m)^t$$



# Migration - Consequences

```
m=0.1
t=seq(1,50)
pm=0.5
p0=0.5
plot(x=pm+(p0-pm)*(1-m)^t,col="blue",lwd=3,type="l",ylim=range(0,1),ylab="allele frequency
(pt)",xlab="time [generation]")
p0=0.2
points(x=pm+(p0-pm)*(1-m)^t,col="red",lwd=3,type="l")
p0=0.0
points(x=pm+(p0-pm)*(1-m)^t,col="orange",lwd=3,type="l")
p0=0.75
points(x=pm+(p0-pm)*(1-m)^t,col="green",lwd=3,type="l")
p0=1
points(x=pm+(p0-pm)*(1-m)^t,col="lightgreen",lwd=3,type="l")
```