

What mode of natural selection is acting on each of the populations below?

	AA	Aa	aa
fitness (w)	0.5	0.6	1

	AA	Aa	aa
fitness (w)	0.5	1	0.4

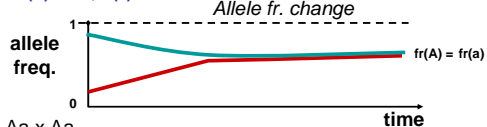
	AA	Aa	aa
fitness (w)	1	0.9	0.6

	AA	Aa	aa
fitness (w)	1	0.7	1

### 3. Balancing selection



$fr(A) = 0.2, fr(a) = 0.8$



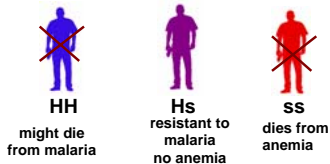
Aa x Aa

	A	a
A	AA	Aa
a	Aa	aa

Genotype fr. change  
 $fr(AA) \rightarrow = 0.25$   
 $fr(aa) \rightarrow = 0.25$   
 $fr(Aa) \rightarrow = 0.5$

### 3. Balancing selection

Example: sickle cell anemia in malaria risk areas



*Plasmodium falciparum* is a protozoan parasite transmitted by mosquito

### Examples of Balancing Selection

#### TAY-SACHS DISEASE (tt)

Deficiency in **hexosaminidase** activity  $\rightarrow$  excessive storage of ganglioside  $\rightarrow$  degradation of nervous system



### 3. Balancing selection – general case

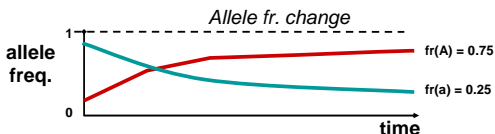
	AA	Aa	aa
fitness:	$1-s_1$	1	$1-s_2$

$\hat{q} = \frac{s_1}{s_1+s_2}$

Example:  $s_1=0.2, s_2=0.6$

$\hat{q} = 0.2/(0.6+0.2)=0.25$

$fr(A) = 0.2, fr(a) = 0.8$



### Examples of Balancing Selection

Susceptibility to Kuru in Fore linguistic group of the eastern highlands of Papua New Guinea



Sertain brain protein is converted into an aberrant form.

**PRNP (PRiON protein) on 20<sup>th</sup> chromosome**

**PRNP has multiple allelic variants**

**Heterozygotes for PRNP locus are resistant to Kuru**

