Hardy - Weinberg Equilibrium.

References:

1) G.H. Hardy (1908) and Hardy-Weinberg Equilibrium, Genetics
   by AWF Edwards

2) Hardy, Weinberg and Language Impediments, Genetics
   by James Crow

~~Let a~~
Assume a population with 2 alleles A, a.
A is dominant and a is recessive.

- Mating is random, the population is infinitely large
- sexes are evenly distributed between 3 genotypes

The ratio of frequencies for the 3 genotypes ~~are~~ is:

$$f(AA) : f(Aa) : f(aa) = x : 2y : z$$

We want to find out ~~that~~ how the frequencies of the genotypes and the gametes will evolve.

① Mating (or Punnett's) table

	AA	Aa	aa
AA	x^2	$2xy$	xz
Aa	$2xy$	$4y^2$	$2yz$
aa	zx	$2yz$	z^2

Then, at next generation:

$$f'(AA) = x^2 + xy + xy + y^2 = (x+y)^2$$
$$f'(Aa) = \ldots\ldots = 2(y+z)(x+y)$$
$$f'(aa) = \ldots\ldots = (y+z)^2$$

Thus, the ratio

$$f'(AA) : f'(Aa) : f'(aa) = (x+y)^2 : 2(x+y)(y+z) : (y+z)^2 =$$
$$x_1^* : 2y_1 : z_1$$

1. The ratio between the genotypes is unchanged when:

i) $(x+y)^2 = x$ and $\Rightarrow$
ii) $2(x+y)(y+z) = 2y$

i) $x^2 + 2xy + y^2 = x \Rightarrow x(x+y) + y(x+y) = x \Rightarrow y(x+y) = x(1-x-y) \Rightarrow$

$y(x+y) = x(y+z)$ [remember $x+2y+z=1$]

$\cancel{xy} + y^2 = \cancel{xy} + xz \Rightarrow \boxed{y^2 = xz}$

obviously this holds for the frequencies after the first generation. Thus, ~~gametic~~ genotypic frequencies will remain constant FROM ~~after~~ the first generation

2. The gametic frequencies

At the generation 0 they are;

$f(A) = x+y$
$f(a) = y+z$

At generatio 1 :

$f(A) = (x+y)^2 + (x+y)(y+z) = x+y$

$f(a) = \;\ldots\ldots\; y+z$

Thus allelic frequencies will remain constant even from generation 0