

## AP Biology Laboratory 8

# Population Genetics and Evolution

### Objectives

- Estimate the frequency of alleles in a population using Hardy-Weinberg equations.
- Demonstrate that allele frequencies can change in a population over time.

### Background

In the early 1900s, many biologists attempted to explain evolution in terms of the emerging science of genetics. Because the  $F_2$  of monohybrid cross show a 3:1 ratio of dominant to recessive phenotypes many assumed that populations would evolve toward similar ratios of phenotypes. Two mathematicians, Godfrey Hardy and Wilhelm Weinberg, realized that the frequency of alleles in a population was independent of the alleles' inheritance pattern from parents to offspring. They postulated an ideal breeding population with the following properties:

1. Population size is infinite, or very large.
2. Mating is random. Mating pairs show no preference for one phenotype over another.
3. There is no mutation.
4. There is no exchange with other populations. No immigration or emigration occurs.
5. There is no selection for one phenotype over another. All phenotypes have an equal chance of reproducing.

If these conditions are met, the population's allele and genotype frequencies will remain statistically constant over time, a condition referred to as Hardy-Weinberg equilibrium. If we determine the frequency of a pair of alleles in a population, we can sample that population over several generations to determine if the frequency changes. If it does, we know that the population is evolving with respect to that pair of alleles.

Hardy and Weinberg developed mathematical formulas for estimating the frequencies of alleles in populations. Consider the following data on Rh blood type for a hypothetical human population of 6000:

**Results of Testing for Human Rh Blood Type**

Blood Type	Number of People
Rh+	4680
Rh-	1320
Total	6000

Assume that Rh blood type is inherited through two alleles:  $D$ , a dominant allele for Rh+ blood type, and  $d$ , a recessive allele for Rh- blood type.

Using Hardy-Weinberg equations, let

$p$  = frequency of the dominant allele ( $D$ )

$q$  = frequency of the recessive allele ( $d$ )

Each person is either Rh+ or Rh-, therefore,

$$p + q = 1 \text{ or } 100\% \text{ of the population.}$$

Since humans are diploid, individuals may be homozygous dominant ( $DD$ ), heterozygous ( $Dd$ ) or homozygous recessive ( $dd$ ). The basic equation must be expanded to represent all the genotype frequencies. Thus,

$$(p + q)(p + q) = 1$$

# Ap Biology Lab Eight Population Genetics Evolution Answers

**Dongyou Liu**



## **Ap Biology Lab Eight Population Genetics Evolution Answers :**

*Molecular Detection of Human Fungal Pathogens* Dongyou Liu, 2011-06-17 The large number of molecular protocols available creates a dilemma for those attempting to adopt the most appropriate for streamlined identification and detection of fungal pathogens of interest *Molecular Detection of Human Fungal Pathogens* provides a reliable and comprehensive resource relating the molecular detection and identification of major **Journal of Biological Education** ,1983 *Animal Breeding Abstracts* ,1961 **The New York Times Index** ,2009 **The Publishers' Trade List Annual** ,1979

**Proceedings of the National Academy of Sciences of the United States of America** National Academy of Sciences (U.S.), 2002 **Sexual Nature/Sexual Culture** Paul R. Abramson, Steven D. Pinkerton, 1995-07 In this multidisciplinary study of human sexuality an international team of scholars looks at the influences of nature and nurture biology and culture and sex and gender in the sexual experiences of humans and other primates Using as its center the idea that sexual pleasure is the primary motivational force behind human sexuality and that reproduction is simply a byproduct of the pleasurable nature of sex this book examines sexuality at the individual societal and cultural levels Beginning with a look at the evolution of sexuality in humans and other primates the essays in the first section examine the sexual ingenuity of primates the dominant theories of sexual behavior the differences in male and female sexual interest and behavior and the role of physical attractiveness in mate selection The focus then shifts to biological approaches to sexuality especially the genetic and hormonal origins of sexual orientation gender and pleasure The essays go on to look at the role of pleasure in different cultures Included are essays on love among the tribespeople of the Brazilian rain forest and the regulation of adolescent sexuality in India Finally several contributors look at the methodological issues in the study of human sexuality paying particular attention to the problems with research that relies on people's memories of their sexual experiences The contributors are Angela Pattatucci Dean Hamer David Greenberg Frans de Waal Mary McDonald Pavelka Kim Wallen Donald Symons Heino Meyer Bahlburg Jean D Wilson Donald Tuzin Lawrence Cohen Thomas Gregor Lenore Manderson Robert C Bailey Alice Schlegel Edward H Kaplan Richard Berk Paul R Abramson Paul Okami and Stephen D Pinkerton Spanning the chasm of the nature versus nurture debate *Sexual Nature Sexual Culture* is a look at human sexuality as a complex interaction of genetic potentials and cultural influences This book will be of interest to a wide range of readers from scholars and students in psychology anthropology sociology and history to clinicians researchers and others seeking to understand the many dimensions of sexuality If we ever expect to solve the sexually based problems that modern societies face we must encourage investigations of human sexual behavior Moreover those investigations should employ a broad range of disciplines looking at sex from all angles which is precisely what *Sexual Nature Sexual Culture* does Mike May American Scientist This timely and relevant book reminds us that we cannot rely on simple solutions to complex problems It represents a transdisciplinary approach integrating knowledge from diverse fields and provides the reader with a challenging and

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