NUTRITION INHERITANCE

The health status of the population in Cambodia is amongst the poorest in Asia. The government spending on health is approximately US$3 per capita per year; donor spending on health has been around twice this level. Private out-of-pocket spending accounts were around 75% of total health spending. The main problems that the public health sector is facing are:

1. shortage of critical skills (e.g. midwives) and mismatch of staff distribution to population need;
2. poorly motivated staff due to low public sector low salaries, fragmented donor salary supplementation, higher earnings in NGOs and private sector, and weak governance and management systems;
3. under-utilization of public health services due to poor quality and accessibility;
4. very limited public financial resources, misallocation and bottlenecks in public and Official Development Assistance expenditure on health, limited protection against high out-of-pocket spending on health services.

These problems and wider socioeconomic problems in Cambodia are leading to lack of progress in improving child and maternal mortality and nutrition outcomes, though progress has been steady in communicable disease control through relatively well funded vertical programs for HIV/AIDS, TB, malaria and immunization. Substantial progress was made in the past decade in reconstruction and development of the public health system following the long period of conflict. Many projects have been launched to tackle key sector weaknesses including the lack of public health facilities, the low numbers of trained health professionals, the limited availability of essential drugs, the low immunization coverage, and the lack of effectiveness of the infectious disease control programs.

BODY MASS INDEX

The **body mass index** (**BMI**), or **Quetelet index**, is a statistical measurement which compares a person's weight and height. Though it does not actually measure the percentage of body fat, it is used to estimate a healthy body weight based on how tall a person is. Due to its ease of measurement and calculation, it is the most widely used diagnostic tool to identify weight problems within a population, usually whether individuals are underweight, overweight or obese. It was invented between 1830 and 1850 by the Belgian polymath Adolphe Quetelet during the course of developing "social physics".

BMI is used differently for children. It is calculated the same way as for adults, but then compared to typical values for other children of the same age. Instead of set thresholds for underweight and overweight, then, the BMI percentile allows comparison with children of the same sex and age. A BMI that is less than the 5th percentile is considered underweight and above the 95th percentile is considered obese. Children with a BMI between the 85th and 95th percentile are considered to be overweight.

In Singapore, the BMI cut-off figures were revised in 2005 with an emphasis on health risks instead of weight. Adults whose BMI is between 18.5 and 22.9 have a low risk of developing heart disease and other health problems such as diabetes. Those with a BMI between 23 and 27.4 are at moderate risk while those with a BMI of 27.5 and above are at high risk of heart disease and other health problems.

Category	BMI range – kg/m^2
Emaciation	less than 14.9
Underweight	from 15 to 18.4
Normal	from 18.5 to 22.9
Overweight	from 23 to 27.5
Obese	from 27.6 to 40
Morbidly Obese	greater than 40

ASSIGNMENT

Body mass index (BMI) is a measure of body fat based on height and weight that applies to both **adult** men and women. At the orphanage, you will work with a sampling of the children and take measurements as follows:

- Set up separate stations for measuring weight and height after recording the name and age of the children
- Measure and collect the weight and height data for each child in a separate sheet of paper.
- Calculate the BMI defined as the individual's body weight divided by the square of his or her height. The formulae universally used in medicine produce a unit of measure of kg/m^2.

Data Collection

Name of Child (Age yrs)	Weight (kg)	Height (m)	BMI

Use separate paper if required

Read the article below

Body mass index and mortality – the risks of being obese

Posted in In the News on March 30th, 2009

A new study was published in *The Lancet* this month, which looked at body mass index (BMI) and cause-specific mortality in almost 900,000 adults.

BMI is a reasonably good measure of how overweight or obese a person is, and is calculated by dividing the weight in kilograms by height in metres squared. A value of over 25 is classified as overweight, and over 30 is obese.

In this latest study, the Prospective Studies Collaboration undertook analyses of baseline BMI versus mortality in 57 prospective studies with 894,576 participants, mostly from western Europe and North America.

Results showed that in both sexes, mortality was lowest at a BMI of about 22.5-25. For each increase of 5 in BMI there was, on average, about a 30% higher all-cause mortality (40% for vascular; 60-120% for diabetic, renal and hepatic; 10% for neoplastic; and 20% for respiratory and all other mortality).

The authors conclude that in adult life, it is easier to avoid substantial weight gain than to lose weight once it has been gained. By avoiding an increase from a BMI of 28 to a BMI of 32, a typical person in early middle age would gain about 2 years of life expectancy.

QUESTIONS

1. Based on your BMI results, what category would the Cambodian sampling of children fall into? And do you concur that the health status of Cambodian is considered as poor when compared to Singapore? Why?

Some Genes Mask the Expression of Other Genes

You are a diploid organism, meaning that you received one set of genes (called alleles) from your father and the other set of alleles from your mother. The combination of these pairs of genes that you've inherited is called your "genotype." The genotype determines the actual traits (called the "phenotype") that you have; such as eye color, nearsightedness, and whether or not you have dimples.

In some instances, the version of a gene that you get from one parent may block the expression of the version of that same gene you received from the other parent. This is a case of a dominant allele masking the expression of a recessive allele. Recessive alleles are only expressed if you inherit two of them, one from each parent.

For example, if your father has brown eyes and your mother has blue eyes, you may have ended up with brown eyes. Your mother's blue eyes are a recessive trait, and although you have an allele for blue eyes, the dark eye allele that you received from your father mask the expression of the blue eye, recessive allele. It is kind of like the game Rock, Paper, Scissors, but in this case, brown beats blue. If you have blue eyes, you had to have inherited a recessive, blue eye allele from both parents.

HUMAN TRAITS

Purpose:

- To observe the expression of a series of genes in an individual's phenotype
- To demonstrate a small part of the range of human variation
- To understand the genetic basis for human diversity

Introduction:

Many of you are already familiar with many of the genetic traits of humans such as baldness, eye color, color blindness and blood types. One often forgets that more familiar characters such as size and position of eyes, number and shape of fingers, total body size and body proportion may also be genetically determined (although such characters as body size may be profoundly influenced by environment). The tremendous number of genetic traits makes humans extremely variable. With the exception of identical twins, it is highly improbable that any two persons will have the same (or even similar) combinations of genetically determined traits.

In this exercise, you will inventory yourself for the series of genetic traits listed in Table 1.1, some of which are illustrated in Figure 1.1. These are known to be single-gene traits, expressions of two alleles at one gene locus.

Procedure

Divide into groups of four children. Go through the traits in Table 1.1; score your own phenotype for each trait in Table 1.2. Write the symbols for your possible genotypes in the space provided (use the symbols given in Table 1.1.). Tally the phenotypes and genotypes for the entire group.

Table 1.1 Single-gene human genetic traits and their alleles.

Trait (alleles)	Expression
Bent pinky ***(B, b)***	Dominant allele causes the distal segment of the fifth finger to bend distinctly inward toward the fourth (ring) finger (Figure 1.1a).
Tongue rolling ***(R, r)***	Persons with a dominant allele in heterozygous or homozygous condition can roll their tongues into a tube-like shape (Figure 1.1b); homozygous recessives are no rollers and can never learn to roll their tongues.
Widow's Peak ***(W, w)***	Dominant allele in heterozygous or homozygous individuals results in a V-shaped front hairline (Figure 1.1c); homozygous recessives have straight hairlines.
Thumb crossing ***(C, c)***	In a relaxed interlocking of fingers, left thumb over right indicates the dominant allele is present in either heterozygous or homozygous individuals; homozygous recessives naturally place the right thumb over the left.
Ear lobes ***(A, a)***	Ear lobes may be either adherent or free and pendulous. Homozygous recessives have attached ear lobes (Figure 1.1d); heterozygous or homozygous dominant individuals have detached (free) ear lobes.
Hitchhiker's thumb ***(H, h)***	Homozygous recessives can bend the distal joint of the thumb backward to a nearly 90º angle; heterozygous or homozygous dominant condition yields thumbs that cannot bend backward more than approximately 30º

The **genotype-phenotype distinction** is drawn in genetics. "Genotype" is an organism's full hereditary information, even if not expressed. "Phenotype" is an organism's actual observed properties, such as morphology, development, or behavior. This distinction is fundamental in the study of inheritance of traits and their evolution.

The genotype represents its exact *genetic makeup* — the particular set of genes it possesses. Two organisms whose genes differ at even one locus (position in their genome) are said to have different genotypes. The transmission of genes from parents to offspring is under the control of precise molecular mechanisms. The discovery of these mechanisms and their manifestations began with Mendel and comprises the field of genetics.

It is the organism's physical properties that directly determine its chances of survival and reproductive output, while the inheritance of physical properties occurs only as a secondary consequence of the inheritance of genes. Therefore, to properly understand the theory of evolution via natural selection, one must understand the genotype-phenotype distinction.

The mapping of a set of genotypes to a set of phenotypes is sometimes referred to as the **genotype-phenotype map**.

Figure 1.1 Phenotypic expressions of single-gene human genetic traits.

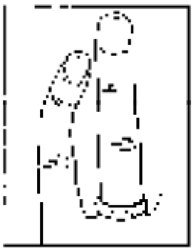

Figure 1.1a. Bent pinky

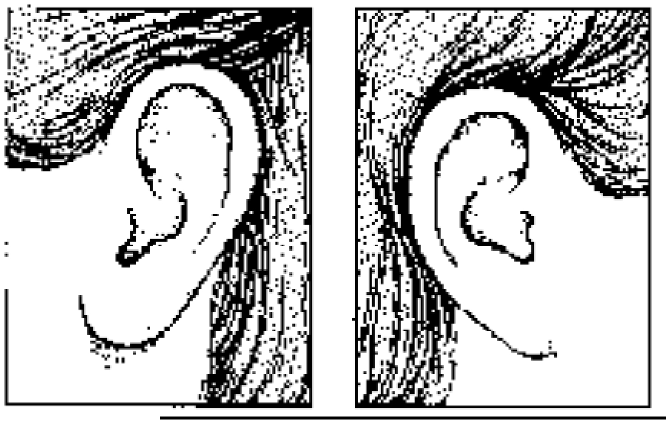

Figure 1.1d. Unattached versus attached ear lobes.

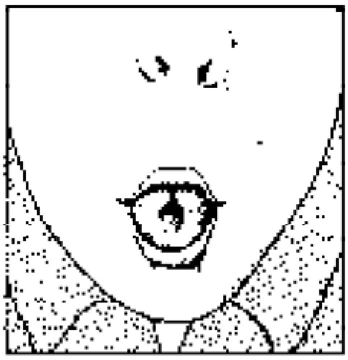

Figure 1.1b . Tongue rolling.

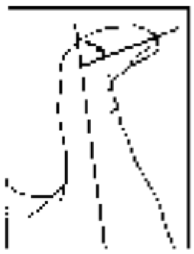

Figure 1.1e. Hitchhiker's thumb.

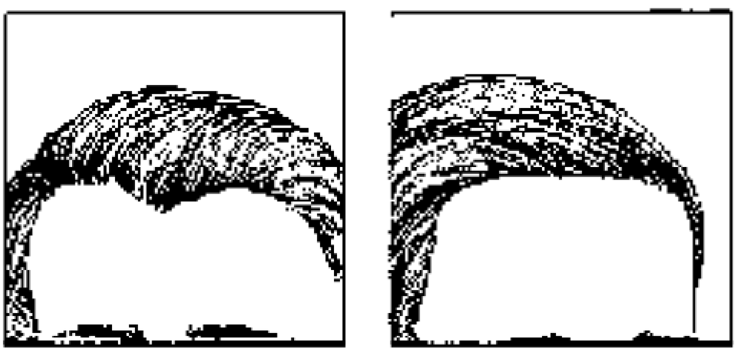

Figure 1.1c. Widow's peak vs. straight hairline.

With the same sampling at the orphanage, record your phenotype and circle your probable genotype in the following chart and determine the percentages of the sampling assigned.

Table 1.2

Trait	Dominant	Recessive	Total # of Sampling	% of Dominant
Bent Pinky				
Tongue-rolling				
Widow's peak				
Thumb crossing				
Ear lobes				
Hitchhiker's thumb				
Dimples				

QUESTIONS

1. Is it true that dominant phenotypes are always the most common in a population? Explain your answer.

2. What determines how often a phenotype occurs in a population?

3. Is it possible to determine the genotype of a person showing a dominant phenotype? A recessive phenotype? Why?