In lecture, we have discussed how variation in human traits is usually clinal, not categorical. Even for simple Mendelian traits, such as blood type, which are controlled by only one pair of loci, the distribution of characteristics changes gradually across populations, rather than discretely between populations. This tends to be even more true of polygenic (non-Mendelian) traits, including the traits we commonly associate with "race", such as skin color and facial characteristics.

For this homework, you will map the distribution of two different biological traits and compare their variation. In each case, use the provided data about the presence of each trait in different countries or regions to color or shade the associated map in a way that illustrates the clinal nature of the variation in the trait. You may use different intensities of pencil coloring or different colors (marker, crayon, colored pencil, etc.) to indicate the different levels. Try to create a meaningful color/shade progression. Use Google maps or some other reference tool when in doubt as to the location of the countries listed.

**Part 1: Lactose Tolerance**

Lactose intolerance is the inability to digest fresh milk because your body does not produce the enzyme lactase, which breaks down the sugar lactose in milk. Most mammals produce lactase when young but lose that ability after weaning. In some human populations, however, milk consumption continues throughout life. In some of these populations, a simple allele change allowed adults to continue producing lactase. It is thought that the distribution of this allele is strongly associated with historical patterns of dairying and milk consumption. Populations that historically relied on milk (for example, pastoralist societies) developed lactose tolerance, while others remained “normal”, i.e., unable to process lactose after childhood.

**Percentage of adults who are lactose tolerant (rough estimates by country):**

- **0-10%**: All countries not mentioned below (note, some of the smallest countries are not mentioned. You can assume they are similar to the countries surrounding them.)


- **20-70%**: Hungary, Romania, Bulgaria, Ukraine, Austria, Poland, and Estonia. Tanzania, Kenya, Ethiopia.

- **70-80%**: Spain and Portugal, Switzerland, France.

- **90-100%**: Southern Sudan. Northern Europe (if not mentioned above)
Part 2: B allele (of ABO blood type)

Human blood type is a simple Mendelian trait. We each receive from our parents an A, B, or O allele. Both A and B are dominant (co-dominant), while O is recessive. There is a great deal of variation in the distribution of A, B and O alleles around the world. Much of this variation seems to be attributable to genetic drift (for example, the B allele is extremely rare among the Indigenous peoples of the Americas, presumably because it was rare among the relatively small founding population), but there may also be natural selection factors involved. For example, some studies have found that malaria is less severe in individuals with type O blood.

Percentage of the population that has the B allele (rough estimates by country):


5-10%: All of Europe west of Poland, Slovakia, and Hungary (except where noted above). Yemen, Oman, and southern Saudi Arabia. Ethiopia and Somalia.

10-15%: All of Africa, except where noted above and below. All of the Middle East, except where noted above and below. All of eastern Europe except Russia. Indonesia and Malaysia. Southern India.


25-30%: Pakistan and Northern India.

Don’t forget to fill in the color key at the bottom of each map!
Distribution of Lactose Tolerance

Percentage of Adults Who Are Lactose Tolerant

- 90-100%
- 70-80%
- 20-70%
- 10-20%
- 0-10%