



Практичне заняття № 5

Read and translate into Ukrainian the following texts:

SOURCES OF GENETIC VARIATION

Selection is probably the most important cause of deviation from Hardy-Weinberg equilibrium because it promotes genetic change in the context of the environment and requires genetic variation. Natural selection can change the frequency of phenotypes, but it must have genetic variation as a raw material to effect change. Where does genetic variation originate? Where do new alleles come from? Genetic variation within populations comes from two main sources: gene flow and genetic drift.

Gene flow. Gene flow is the transfer of genetic material from one population to another. It typically occurs through migration of individuals or movement of seeds or pollen to neighboring populations or, in some cases, to distant populations. For example, the grass *Botriochloa intermedia* seems to have incorporated genes from many other grasses, including *B. ischaemum* in Pakistan, *B. insculpta* in eastern Africa, and *Capillipedium parviflorum* in northern Australia.

Gene flow minimizes geographic variation in gene pools; that is, it decreases genetic differences between populations. Gene flow frequently occurs between neighboring populations, and it significantly minimizes the differences between these populations. Gene flow between distant or isolated populations is rare, which allows their gene pools to diverge over time. Reduction in gene flow partially explains why islands isolated by water are geographically more varied and more likely to produce new species than are vast expanses of grassland, and why lakes and streams contain more geographic variation among populations than oceans. Separated populations of a species are seldom genetically identical, and the differences coincide with the distance between populations.

Gene flow in plant populations is difficult to measure, but it can be experimentally estimated by planting recessive homozygotes at various distances from a strain marked with a dominant allele and then examining the distribution of heterozygous progeny. Using this technique, A. J. Bateman measured pollen dispersal in wind-pollinated (e.g., corn) and insect-pollinated (e.g., radish) crops. The proportion of corn plants receiving the dominant allele by gene flow decreased exponentially with distance and was reduced to 1% at only 13-16 meters from pollen source. Similarly, most pollen of insect-



pollinated plants is carried only a short distance; however, the small proportion that is carried farther may contribute importantly to gene flow.

Genetic drift. Genetic drift refers to changes due to chance in the gene pool of a small population. In small populations, chance events such as mutation, mating, or pollination may significantly affect the gene pool and change gene frequencies independently of natural selection. If, for example, one individual in a small population carries the only copy of an allele, then the passage of that allele to the next generation may depend largely on the vagaries of insect pollination or random, lethal storms rather than natural selection. Favorable alleles in a small population can be eliminated by chance alone. Similarly, catastrophic damage to or death of well-adapted individuals may increase the frequency of the alleles of less fit but surviving individuals. Current research indicates that genetic drift may be a more significant force for changing gene frequencies than previously assumed. This would be especially true for the frequencies of genes that are not subjected to heavy selection pressure.

CYTOPLASMIC INHERITANCE

You learned that chloroplasts and mitochondria contain DNA. Genes in these organelles control certain aspects of photosynthesis and respiration, respectively. Inheritance of these genes is independent of sexual reproduction because they are transmitted to offspring with the cytoplasm, usually that of the maternal parent.

One example of cytoplasmic gene control occurs in certain forms of the cultivated four-o'clock (*Mirabilis jalapa*) that have yellowish-white leaves instead green leaves. This difference in leaf color is caused by defective chloroplast genes. Phenotypic expression depends solely on the seed parent. Thus, when pollen from a white-leaved plant is transferred to a green-leaved plant, all the offspring have green leaves. In contrast, all the offspring of the reciprocal cross have white leaves. This is an example of the cytoplasmic inheritance of non-nuclear genes.

The cooperation of organellar and nuclear genes is often necessary for normal metabolism. For example, the photosynthetic enzyme ribulose-1,5-bisphosphate carboxylase/oxygenase has two subunits, one derived from a nuclear gene and one from a chloroplast gene. Similarly, some ATPases have a dual origin between the nucleus and mitochondria. In each case, the final product – that is, a complete and functional enzyme – depends on genes from two sources in the same cell.



ПРОФЕСІЙНО-ОРІЄНТОВАНИЙ ПРАКТИКУМ ІНОЗЕМНОЮ МОВОЮ

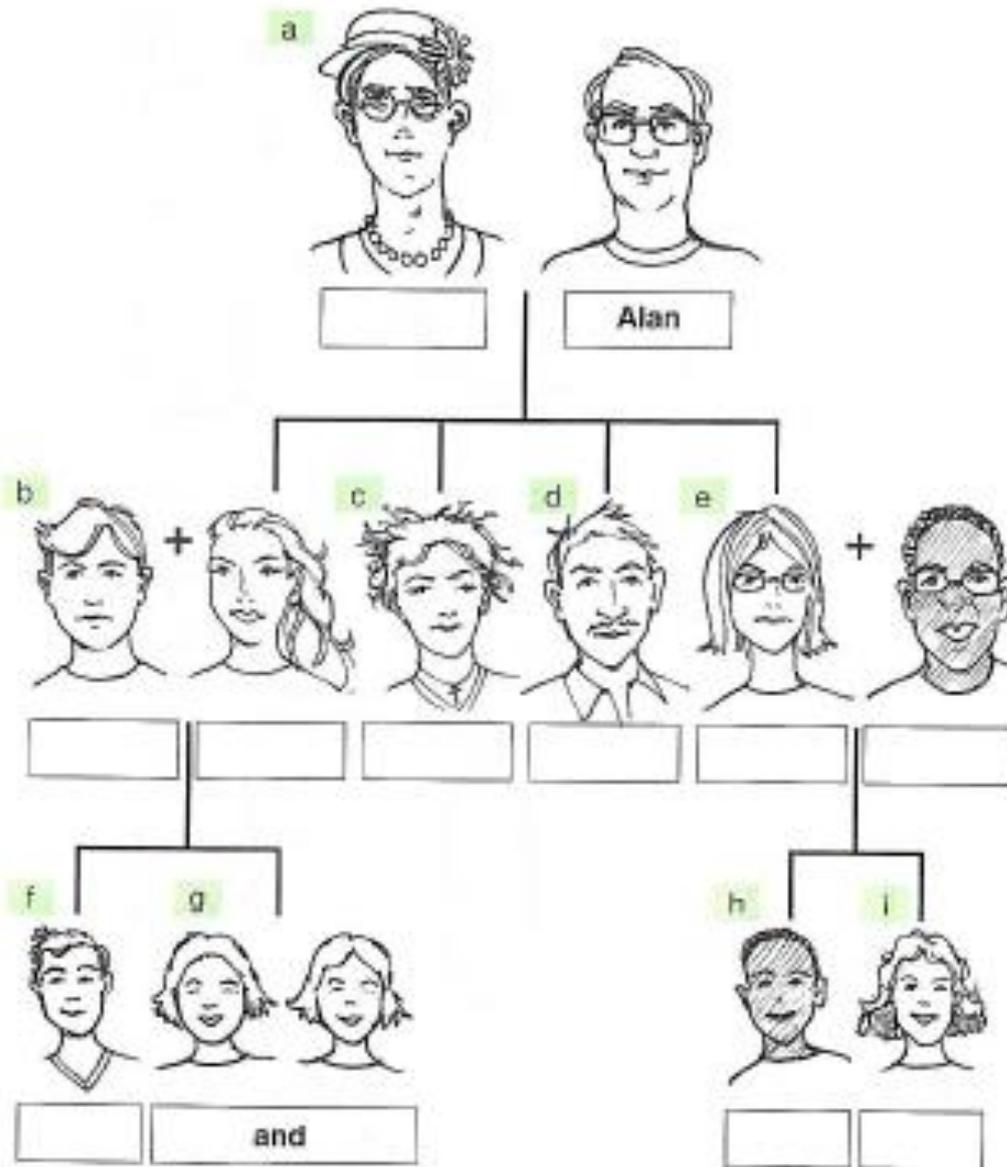
TYPES OF DOMINANCE

The seven genes by Mendel all exhibit complete dominance, which is a relatively rare type of inheritance. Complete dominance occurs when one trait completely masks its recessive allele. More frequently, the phenotype for one allele is only partly masked by the other, a condition called incomplete dominance. Incomplete dominance occurs when hybrids have a phenotype intermediate between those of the two parents. For example, the allele for red flowers in camellia (*Camellia japonica*) is incompletely dominant over the allele for white flowers. As a result, the F_1 offspring is 1:2:1 (25% red, 50% pink, 25% white). Accordingly, in cases of incomplete dominance, the phenotypic and genotypic ratios are the same.

Codominance occurs when both alleles of heterozygote are expressed equally, so there is really no dominance at all. Codominance is common for heterozygous genes that code for two equally functional enzyme. This means that there is more than one form of the same enzyme. The different forms of enzymes made by different alleles of the same locus are called allozymes. Although allozymes catalyze the same reaction, they differ from each other by one or a few amino acids, which makes them slightly different from each other in size and overall electric charge. For example, in wild sunflower (*Helianthus debilis*), there are allozymes of phosphoglucosmutase, which catalyzes one of the first reactions in glycolysis. Heterozygotes produce both forms of the enzyme, but homozygotes produce only one or the other.

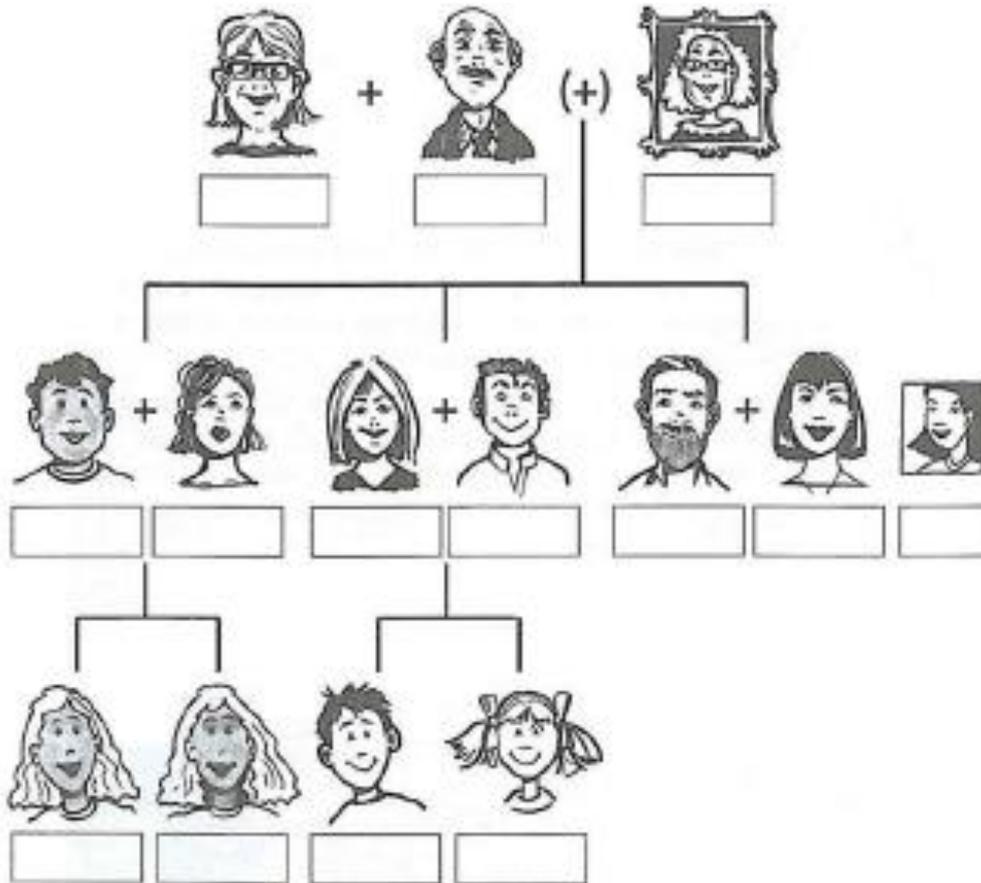
 Write the correct names into the pedigree based on the text given below:

My name's Charlotte. I'm married to John. We have two children, Stephen and Sylvia. My mum's name is Theresa and my father is called Alan. I have two sisters and a brother – Emily, Rebecca and Michael. Emily's married to Craig and they have a son called Freddie and twin daughters, Lizzie and Vicky.



✎ Write the correct names into the pedigree based on the text given below:

My name's Heidi. I'm married to Kerim. We have two children, Aisha and Leila. My mum, Wendy, died when I was a teenager. My dad, Keith, got married to Katrina fourteen years ago. I've got one sister, Gina, and one brother, Andy. Gina's married to Kean-Claude, who's French. They've got a little girl called Julie and a boy of twelve called Michael. My brother Andy was married to a girl called Caroline but they got divorced. Luckily they didn't have any children. Now he's married to a girl called Susanna.



✎ Write the numbers of the corresponding figures

- Cell coat ____ centriole ____ chromatin ____ cytoplasm ____ free
 ribosome ____
 Goldi body ____ lysosome ____ mitochondrion ____ nuclear envelope

 nuclear pore ____ nucleolus ____ nucleus ____ plasma membrane

 ribosome ____ rough endoplasmatic reticulum ____
 smooth endoplasmatic reticulum ____

