--**Chapter 13**--

(each task of this chapter is dedicated as 13.x (x meaning the exact task from book of edition in 2009)

13.1

Phenotype	Number of		
	Persons	Alleles *M*	Alleles *N*
M	**406**	**812**	**0**
MN	**744**	**744**	**744**
N	**332**	**0**	**664**
Total	**1482**	**1556**	**1408**

Allelic frequency of *M* $p_{(M)} = \frac{2\times406+744}{2\times1482} = \frac{1556}{2964} = 0.525$

Allelic frequency of *N* $q_{(N)} = 1 - p_{(M)} = 0.475$

13.2

a. frequency of *T* = 0.452, frequency of *t* = 0.548 (H-W equilibrium)
b. frequency of *T* = 483/1552 (0.31), frequency of *t* =(556+483)/1522(0.68)
c. it is not random mating in b population, genotype and number of tasters is known (Tt/483)

13.3

a. frequency (*D*) = 0.6, frequency (*d*) = 0.4, frequency (*DD*) = 0.36, frequency (*Dd*) = 0.48, frequency (*dd*) = 0.16
b. 0.84 (Rh^- woman makes the choice)
c. 0.16 x 0.84
d. 60%
e. 36%

13.4

a. PKU: frequency of recessive allele „*a*“ is 1/90, dominant allele „*A*“ has frequency 89/90, $p^2_{(AA)}$ = 97.77%, $2pq_{(Aa)}$ = 2.22% (1/45), $q^2_{(aa)}$ = 0.0001%
b. CF: frequency of recessive allele „*a*“ is 1/50, dominant allele „*A*“ has frequency 49/50, $p^2_{(AA)}$ = 96%, $2pq_{(Aa)}$ = 4% (1/45), $q^2_{(aa)}$ = 0.04% (1/2500)

13.5

a. 24%
b. 56%
c. 25%
d. 6%

13.6

a. after 50 generations
b. after 7450 generations
c. 100% *Comment:* This does not make sense. 49 generations ago, everybody would have to have cystic fibrosis. Use of this model was wrong (not completely). One of the assumptions of H-W equilibrium is that no selection exists.

13.8

Sickle cell anemia: (solved in a protocol)

Genotype	*AA*	*AS*	*SS*	Total
number of individuals	9365	2993	29	12387

fr. (*A*) = (2x *AA* + *AS*)/2 x total = 0.877; fr. (*S*) = 0.123

It seems that the population is not in H-W equillibrium, because numbers of recessive homozygotes do not reflect the genotypes where there is at least one dominant allele *A*, when we apply H-W formulas. For example, when you use the calculated frequency of recessive allele (*S*) 0.123, you expect to have 187 individuals with *SS* genotype. However, statistical tests must be applied to confirm that some significant distractors exist (selection for example).

We expect 187 *SS* individuals, but we have 29, and we expect 9527 *AA* individuals, but we have 9365. From these numbers we can deduce the fitness *w* of individual genotypes and then the s_1 and s_2 coefficients.

13.9 Albinism.

$$q_{equil} = \sqrt{\frac{\mu}{s_{aa}}} \quad \Rightarrow\Rightarrow\Rightarrow \quad \mu = q_{equil}^2 \times s_{aa} \qquad \mu = \frac{1}{20000} \times 0.1 = 2 \times 10^{-5}$$

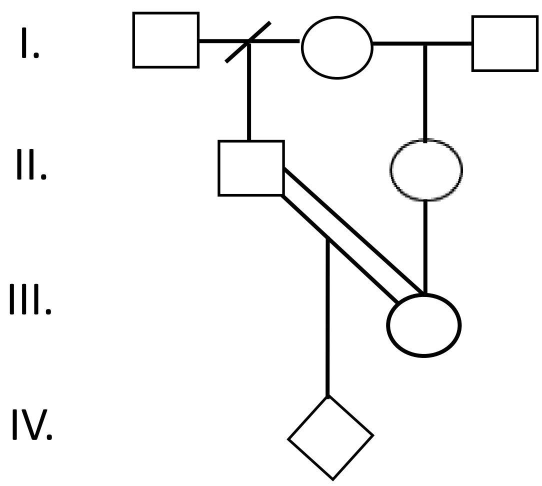
13.10 Induced Mutations

Altered sex ratio at birth is widely studied; disturbances are seen on both sides. For example, Dioxin exposure is associated with a lower male:female sex ratio in offspring of exposed men, while PCB (polychlorinated biphenyl) exposure is associated with a higher male:female sex ratio in offspring of exposed men. <u>Radiation produces recessive lethal mutations on the X chromosome.</u> Irradiated males with X chromosomes defects have higher amount of unaffected Y sperm cells. Irradiated women with recessive lethal mutations on their X chromosome tend to have more girls. Since baby girls have two X chromosomes they may cope with the mutation damage better than baby boys. The length of the period between irradiation and conception has a striking effect on the mutation frequencies seen in the offspring.

13.12 Consanquinity and inbreeding

$$r = \left(\frac{1}{2}\right)^3$$

$$F = \left(\frac{1}{2}\right)^4$$



13.13 Migration

$m = (p_i' - p_i)/(p - p_i) = 30\%$