NTNU

Faculty of Medicine
Department of Laboratory Medicine, Children's and Women's Health

Exam MOL3001
Medical genetics

Thursday 31 May 2012, 9.00 am - 1.00 pm

ECTS credits: 7.5
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Examination support: Calculator and English dictionary

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Examination results are announced on http://studweb.ntnu.no/

All questions are equally rated (25% for each of question 1-4). Some of the subquestions are not equally rated (these are marked)

Examination question 1.

a) Genetic profiling (DNA fingerprinting) is used in forensic medicine, paternity examination and evolutionary research.
Describe which parts of the human genome are used to make a genetic profile, and explain important requirements for these markers in an identification protocol (80%). Do identification protocols tell anything about gender (20%)?

b) An autosomal VNTR marker used in the profiler protocol produces ten alleles, each with a frequency of 0.1. How large proportion of the population (in %) is expected to be heterozygous at this marker locus?

c) What is a karyotype? Which chromosome aberrations are most common seen in prenatal testing, and what is the most common source of these aberrations?

Examination question 2.

a) What is the most common type of gene involved in inherited cancer syndromes? Describe differences between inherited and sporadic forms of cancer.

b) Describe the inheritance pattern most often seen in hereditary cancer syndromes. Include and describe the factor of penetrance. Use example.

c) There are exceptions from the most common type of gene involved in hereditary cancer. Describe such an example. There are also exceptions from the most common inheritance pattern seen in hereditary cancer. Describe an example.

Examination question 3.

a) Osteogenesis imperfecta is a dominant disorder of the structural protein procollagen. This disease shows high degree of variable expressivity, from mild to perinatal lethal phenotypes. Explain why the phenotype may be milder when the mutation leads to no polypeptide formation (null mutation), compared to mutation causing polypeptides with structural defects.

b)
Explain why some boys with an X-linked disease which usually is lethal can grow up. Explain why some girls which are carrier of a mutated allele for a recessive X-linked disease may have very variable phenotypes, from asymptomatic to quite severely affected.

c) Explain how the Norwegian Act of Biotechnology (”Bioteknologiloven) regulate predictive / presymptomatic testing and testing of children.

Examination question 4.

a) Linkage analysis in families is an important tool to map disease genes. Linkage analysis in one family revealed a LOD score ($\log_{10}$ of odds ratio) of +1,87 for linkage between a RFLP marker and the unknown disease gene. The analysis was repeated in a second family, and this time the LOD score was +2,23. What is the evidence for linkage between the marker and the disease gene?

b) Increased resistance in heterozygote individuals (“heterozygote advantage”) may explain the maintenance of some genetic disorders in certain populations. Explain how we can use the Hardy Weinberg principle to demonstrate heterozygote advantage for an autosomal recessive condition in a population, if we know the true genotype distribution in the population.

c) Explain in general terms the factors that contribute to a person’s risk for developing a complex (multifactorial) disorder. Describe how the “inheritance pattern” of complex disorders differs from those of monogenic disorders, and explain how “twin-studies” can be used to estimate the relative contribution of the main factors involved.

Made by Frank Skorpen, Inga Bjørnevoll og Wenche Sjursen