

Question 1

Which primers pair should be used to amplify the following DNA sequence?

5' ATCGGCTATCGACTACGGGATTCATCAGGCTACGGGCATCTATATTATCGGTATCGA 3'
 3' TAATAGCCATAGCT 5'

5' ATCGGCTATCGACT 3'

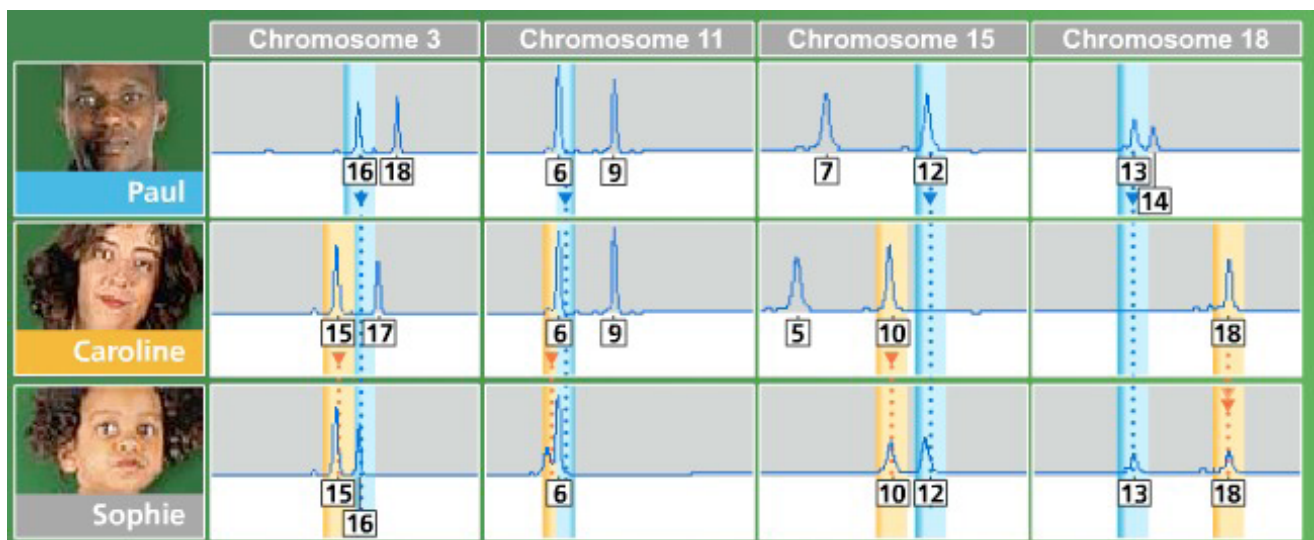
3' TAGCCGATAGCTGATGCCCTAAGTAGTCCGATGCCCCGTAGATATAATAGCCATAGCT 5'

Primers :

- A. 5' ATCGGCTATCGACT 3' et 5' ATTATCGGTATCGA 3'
 B. 5' ATCGGCTATCGACT 3' et 5' TCGATACCGATAAT 3'
 C. 5' TAGCCGATAGCTGA 3' et 5' ATTATCGGTATCGA 3'
 D. 5' AGTCGATAGCCGAT 3' et 5' TCGATACCGATAAT 3'

Binding must be antiparallel

Question 2



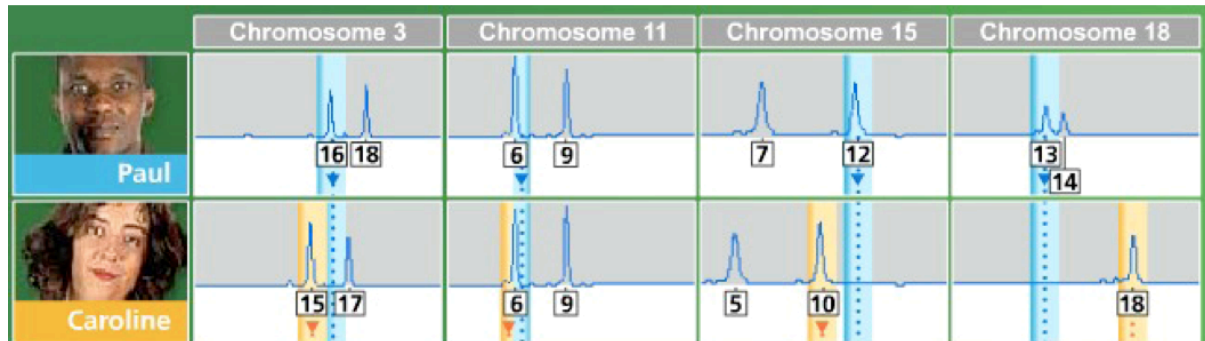
Paul and Caroline have a second child (Adrian):

What is the probability that Adrian's DNA profile is *identical* with Sophie's profile for the 4 loci shown?

$\frac{1}{4} \times \frac{1}{4} \times \frac{1}{4} \times \frac{1}{2} = \frac{1}{128}$

Show your calculations.

Question 3



Paul and Caroline plan to have two children. What is the probability that their 2 children will have an identical DNA profile for the 4 loci shown? (Assume that the 2 children are not monozygotic twins)

$$\frac{1}{4} \times \frac{3}{8} \times \frac{1}{4} \times \frac{1}{2} = \frac{3}{256}$$

Show your calculations.

Question 4

In the human genome a highly polymorphic microsatellite exists in 10 variants (10 alleles, 10 different lengths). One analyzes this locus in 2 persons picked randomly (a European and an Asiatic, they are not relatives).

4.1 What is the probability that these 2 persons have the same genotype at the tested locus? (assume the same frequency for all alleles)

There are 55 genotypes : 10 homozygotes ($P = 1/100$) 45 heterozygotes ($P = 2/100$)

$P(\text{identity}) (10 \times 1/100 \times 1/100) + (45 \times 1/50 \times 1/50) = 1/1000 + 9/500 = 19/1000$

Show your calculations. Note : $1/55 = 0.0181$ close but not totally correct

4.2 What is the probability that these 2 persons have identical DNA profiles.

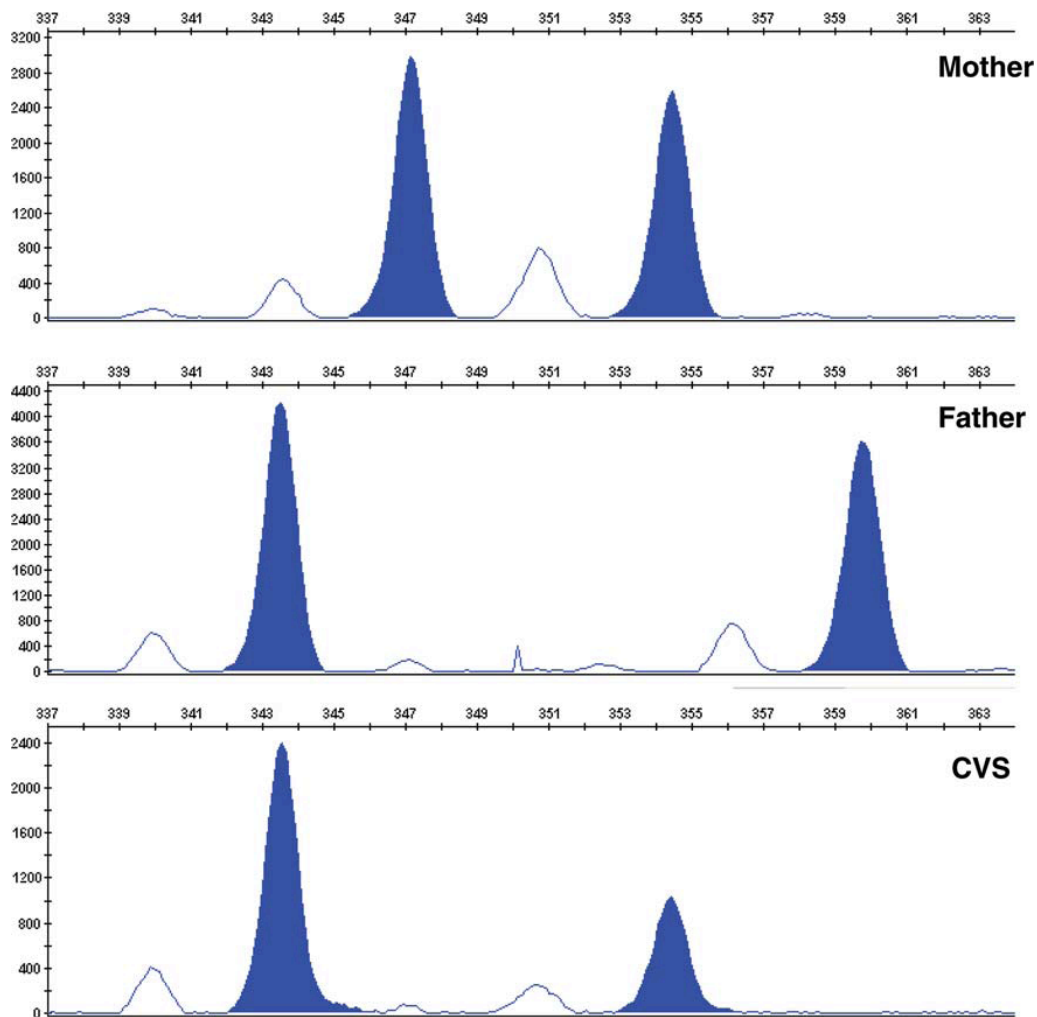
Assume a profile made of 10 loci; 10 alleles at each locus, same frequency for all alleles at all loci (as in question 4.1)

$$\frac{(19/1000)^{10} = 6 \times 10^{-18}}{\text{World population } 9 \times 10^9}$$

Show your calculations.

Question 5

A prenatal test is done on a fetus: the microsatellite D21S1414 has been analyzed in the mother, the father and the fetus. For the fetus a placenta biopsy (Chorionic Villi Sample CVS) has been obtained. (real case, real analysis)



What do you conclude from the analysis?

5.1 The test excludes the “official” father as the biological father.

A. RIGTH

B. **WRONG**

5.2 The child is

A. normal

B. **abnormal (trisomy 21)**

5.3 If you think that the child is abnormal precise what is the problem and what happened.

The father gave 2 copies of one of his chromosomes 21. Paternal origin is rare (1/10) compare to the maternal origin (9/10)