1. For each child listed below, list all of the following non-disjunction events that could have led to the creation of a gamete that could have produced this child. Your choices are:

- non-disjunction during gamete formation
- in the mother during meiosis I
- in the mother during meiosis II
- in the father during meiosis I
- in the father during meiosis II

(a) an XO female child

(b) an XYY male child

(c) an XXX female child

(d) an XXY male child
2. Predict the phenotypic concordance rates of monozygotic (MZ) and dizygotic (DZ) twins for the following rare traits on which environmental effects are negligible. Assume that each trait shows complete penetrance and does not affect fitness of those with the trait.

What are the concordance rates for MZ and DZ twins…

(a) … if at least one twin in each set is expressing a specific autosomal trait caused by the presence of dominant alleles at two unlinked loci (ie. only “A_B_” individuals show the phenotype)?

(b) … if at least one twin in each set is expressing a specific autosomal trait caused by the presence of recessive alleles at two unlinked loci (ie. only “aabb” individuals show the phenotype)?

(c) … if at least one twin in each set is a man expressing a specific X-linked recessive trait?
3. The following is a pedigree showing a couple that has a child with trisomy of chromosome 21. The schematic of a gel is shown below, which reveals the genotypes of each member of the family at two different SSRs found on chromosome 21.

For parts (a) and (b), assume that the band in the gel corresponding to the H allele in the child is significantly more intense than the band corresponding to the E allele.

(a) Can you conclude in which parent the non-disjunction event occurred? If so, in which parent did the non-disjunction event occur? Explain your answer.

(b) Can you conclude whether non-disjunction occurred in meiosis I or meiosis II? If so, in which meiotic division did the non-disjunction event occur? Explain your answer.
For parts (c) through (g), assume that the band in the gel corresponding to the E allele in the child is significantly more intense than the band corresponding to the H allele.

(c) Can you conclude in which parent the non-disjunction event occurred? If so, in which parent did the non-disjunction event occur? Explain your answer.

(d) Assuming that SSR13 is centromere-linked, in which meiotic division did the non-disjunction event occur? Explain your answer.

(e) Assuming that SSR13 is centromere-linked, draw the meiosis that created the gamete that led to the production of the child shown in the pedigree. Assume the parents' phases are as shown below.

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  B   G
   C   H

  A   E
   C   F
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In each cell, draw chromosome 21 AND another chromosome of a different size that undergoes meiotic chromosome segregation normally. Please label each SSR allele and the centromere on each homolog of chromosome 21. Show the initial cell and then that cell after having undergone each of the following steps of the meiotic cell cycle in the following order: DNA replication, chromosome alignment during metaphase I (please indicate where any recombination events occurred), and chromosome alignment during metaphase II. Then show the four final products of the meiosis. (Please indicate the gamete that led to the creation of the child with trisomy 21 with a star.)
(f) Now assume that SSR14 is centromere-linked (instead of SSR13). In which meiotic division did the non-disjunction event occur? Explain your answer.

(g) Assuming SSR14 is centromere-linked (instead of SSR13), draw the meiosis that created the gamete that led to the production of the child shown in the pedigree. Assume that the parents’ phases are the same as shown in part (e). Follow the instructions from part (e).