

6.2 Mendelian inheritance and pedigrees

Name: _____ Class: _____ Date: _____

Total: 23 marks

KEY WORDS pedigree

Objective

Identify inheritance patterns from pedigrees and compute segregation risks.

1 Key knowledge and worked examples

■ The signatures

AD: vertical, father-to-son. AR: horizontal, consanguinity, 1/4. X-linked recessive: no male-to-male. X-linked dominant: affected father → ALL daughters, no sons ✓.

■ Worked example: risk down the pedigree

AD parent (Aa) $\times$ aa → each child 1/2; an affected child's children again 1/2 ✓ – vertical 1/2s.

2 Practice

2.1 Which pattern never shows male-to-male transmission? [3]

2.2 Two carriers' affected-child risk? [3]

2.3 An affected father (X-linked dominant) has daughters – risk? [3]

3 Exam-style questions

3.1 A woman (28, unaffected) has an affected parent with an adult-onset AD condition (fictional).

Compute her prior risk ($1/2$). Explain how being unaffected at 28 modifies it (onset distribution – Bayes). State what a predictive test would change. [7]

3.2 Achondroplasia in a child of two average-height parents (fictional).

Explain the de-novo mutation logic ($\sim 80\%$, paternal age). Give the sib recurrence (near population) and the child's own offspring risk ($1/2$). State the germline-mosaicism caveat. [7]

Solutions

2.1

- X-linked (both recessive and dominant).

2.2

- $1/4$ ✓.

2.3

- All daughters affected (100 %), no sons affected ✓.

3.1

- Prior risk $1/2$ (affected parent is Aa).
- If say 40 % of carriers have onset by 28: $P(\text{unaffected at 28} \mid \text{carrier}) = 0.6 \rightarrow \text{posterior} = (1/2 \times 0.6) / (1/2 \times 0.6 + 1/2 \times 1) = 0.375$ – evidence, not proof.
- Predictive testing resolves it to ~ 0 or ~ 1 (with counselling on insurability and psychological burden).

3.2

- ~ 80 % de-novo (FGFR3, paternal age effect).
- Sib recurrence near population risk; the child's own children at $1/2$.
- Germline mosaicism in a parent gives a small recurrence above population (~ 1 %).