

Exercise walk-through

10.4

Neoplasia

University Medicine

Neoplasia: gates to metastasis

- 1 **Cascade** Detach (E-cadherin lost) → degrade basement membrane (MMPs) → intravasate → survive (few of 10,000 cells) → extravasate → colonise a hospitable soil (seed and soil).
- 2 **Axes** Grade = appearance (Gleason 2-10); stage = TNM extent — prognosis follows stage first.
- 3 **Routes** Lymphatic (carcinoma) · blood (sarcoma, kidney, liver) · transcoelomic (ovary).

The invasion-metastasis cascade

six gates, each low-probability — metastasis is selection, not leakage



benign vs malignant

	benign	malignant
differentiation	well-kept	lost (pleomorphism)
growth	slow, capsule	rapid, invasive
spread	stays local	METASTASISES
example	lipoma	adenocarcinoma

grade vs stage — two different axes

GRADE = how the cells LOOK (differentiation)
prostate: Gleason 2-10 (two patterns summed)

STAGE = how FAR the disease has reached
TNM: T1-T4 size/invasion · N0-N3 nodes · M0/M1 spread
routes: lymphatic (carcinoma) · blood (sarcoma, kidney, liver) · transcoelomic (ovary seeds the peritoneum)

Detach, degrade, enter, survive, exit, colonise — six gates to **metastasis**.

Exercises 2.1-2.3

2.1 What single property defines malignancy? [3]

2.2 Grade vs stage – define each in one clause. [3]

2.3 Which route do sarcomas favour? [3]

Exercises 2.1-2.3

2.1 What single property defines malignancy? [3]

2.1

- Metastasis – benign tumours never metastasise ✓.
-

2.2 Grade vs stage – define each in one clause. [3]

2.2

- Grade = how the cells LOOK (differentiation); stage = how FAR they have reached (TNM) ✓.
-

2.3 Which route do sarcomas favour? [3]

2.3

- Haematogenous (bloodstream) – carcinomas go lymphatic-first ✓.

Exercise 3.1

3.1 A fictional report reads: poorly differentiated; invades muscle; 3 of 12 nodes positive; no distant deposits.

Extract the grade cue (poorly differentiated) and the TNM reading (muscle invasion raises T; N1 for nodes; M0) ✓. Explain why prognosis follows stage first (reach beats look) and which finding would change management most (a new M1 deposit) ✓. [8]

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3.1

- Grade cue: poorly differentiated ✓.
- Stage: muscle invasion (high T), N1 (3/12 nodes), M0 ✓.
- Prognosis follows stage – reach outranks look; grade refines ✓.
- An M1 deposit (distant spread) changes management most ✓.

Exercise 3.2

3.2 A fictional teaching calculation: a tumour sheds $\sim 10^6$ cells/day into the circulation; few of 10,000 survive to colonise.

Explain why circulating cells $\neq$ metastases (six low-probability gates: detach, degrade, intravasate, survive, exit, colonise – seed AND soil) ✓. Predict first destinations for breast carcinoma (axillary nodes, lymphatic) vs osteosarcoma (lung, haematogenous) ✓. [7]

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3.2

- Circulating cells die or fail to colonise: each gate filters – few of 10,000 found a hospitable soil ✓.
- Cascade: detach $\rightarrow$ MMPs $\rightarrow$ intravasate $\rightarrow$ survive $\rightarrow$ extravasate $\rightarrow$ colonise ✓.
- Breast carcinoma: lymphatic-first $\rightarrow$ axillary nodes ✓.
- Osteosarcoma: haematogenous $\rightarrow$ lung ✓.