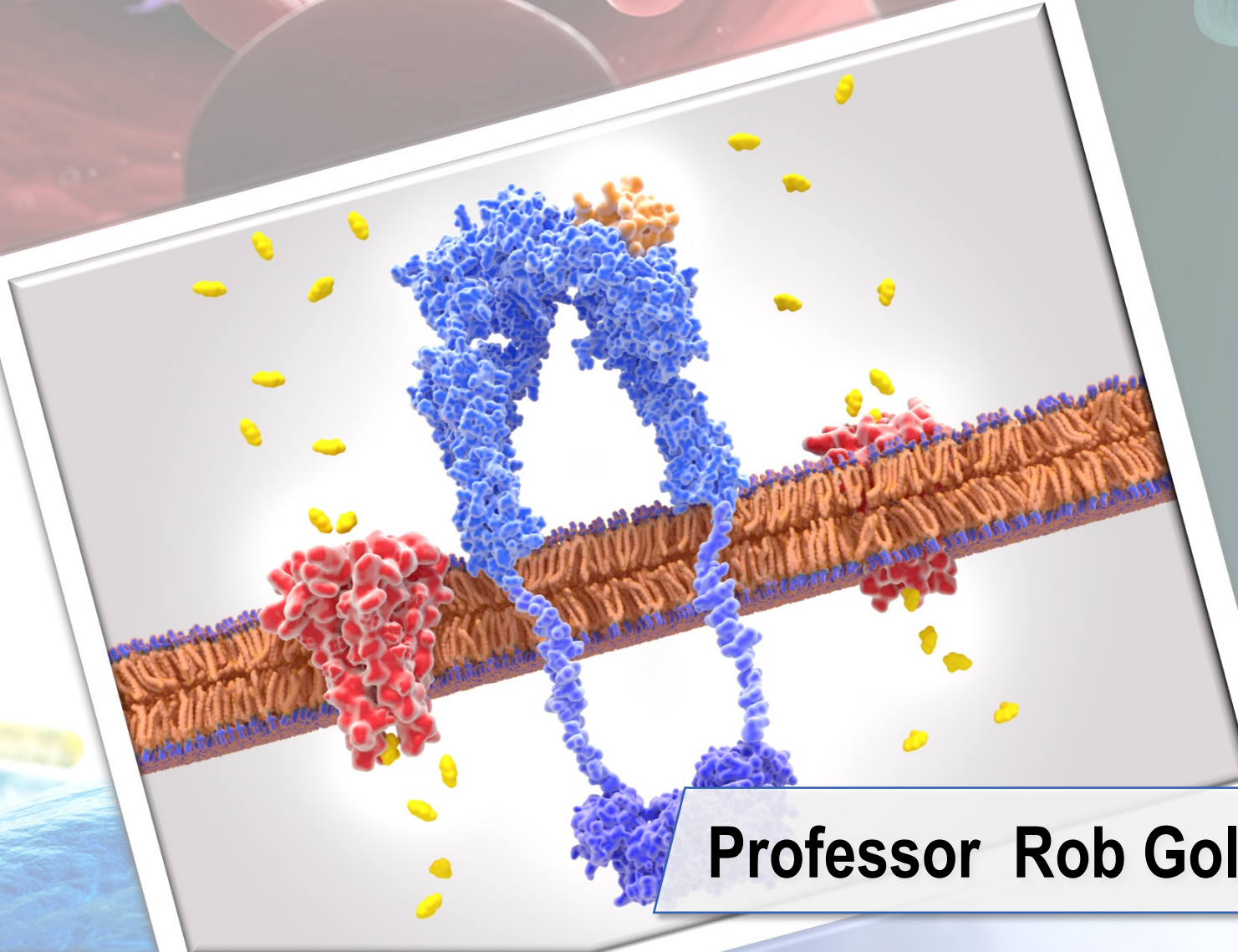


IMPERIAL

Cancer



Professor Rob Goldin r.goldin@ic.ac.uk

Session Plan



Part 1

- The hallmarks of neoplasia

Part 2

- The differences between between benign and malignant neoplasms.

Part 3

- The route by which neoplasms spread.

Session Plan



Part 1

- The hallmarks of neoplasia

Part 2

- The differences between between benign and malignant neoplasms.

Part 3

- The route by which neoplasms spread.
-

Nomenclature I



- **Tumour:**

Any kind of mass forming lesion.

May be neoplastic or non- neoplastic
(hamartomas, inflammatory or heterotopias).

Nasal polyps: A non-neoplastic tumour



Nomenclature II



- **Neoplasm:**

The autonomous growth of tissue which have escaped normal constraints on cell proliferation.

Lung cancer: A neoplastic tumour



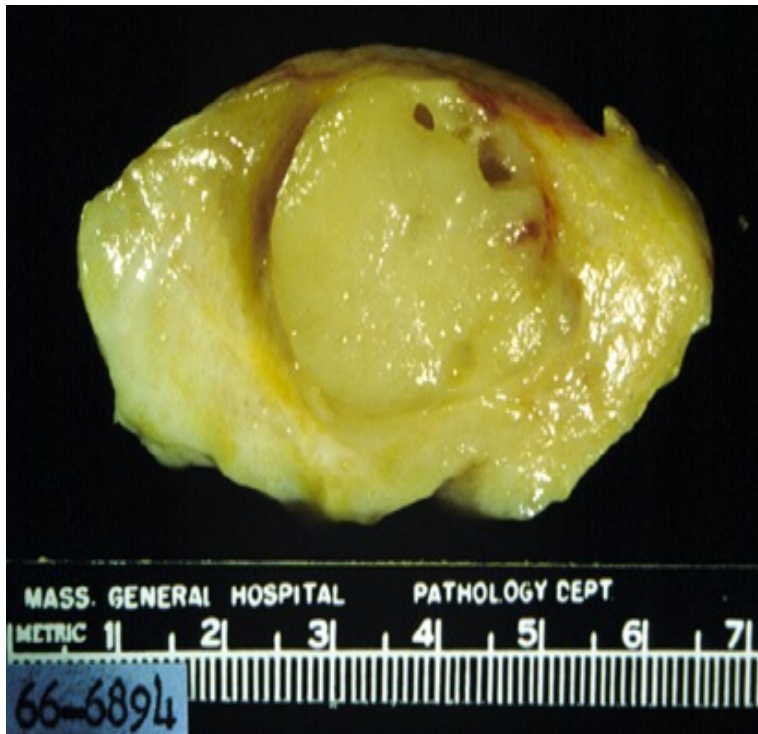
Nomenclature III



- Neoplasms may be either **benign** (remain localised) or **malignant** (invade locally and/or spread to distant sites). The spread to distant sites is call metastasis.
- **Cancers** are malignant neoplasms.



Benign Neoplasm



Malignant Neoplasm



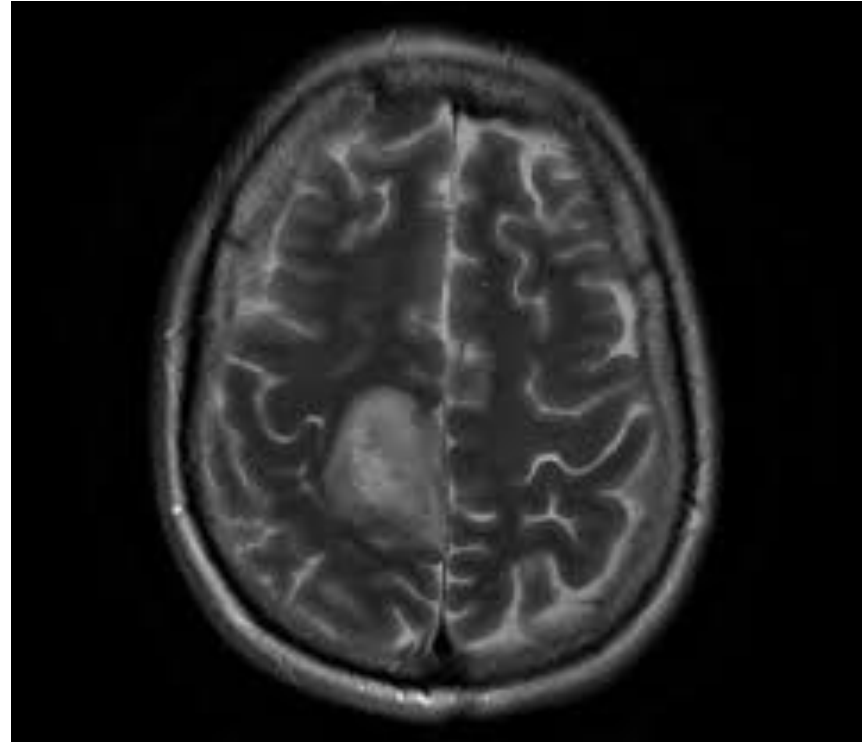


- Important to note that many malignant tumours rarely cause death (especially skin cancers) and that some benign tumours do kill (usually because of their location, e.g. the brain)

Basal cell carcinoma



“Benign” brain tumour

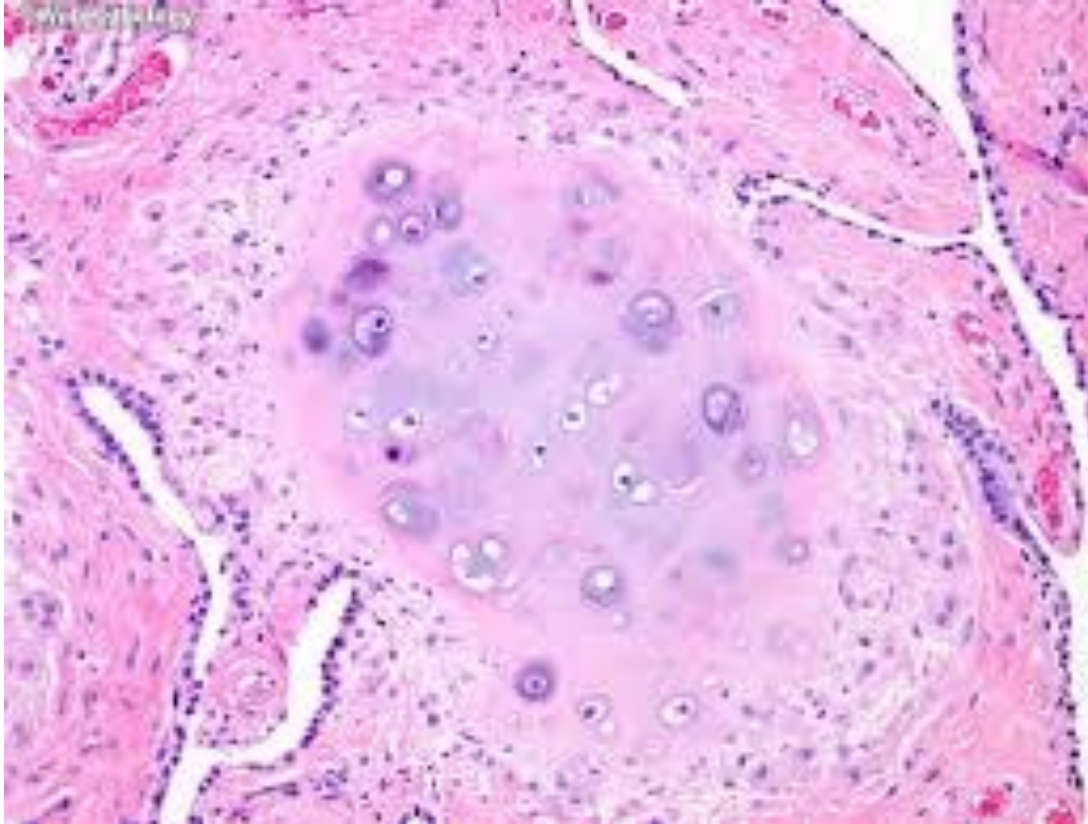


Hamartomas



- These are localised benign overgrowths of one of more mature cell types e.g. in the lung.
- They represent architectural but not cytological abnormalities.
- For example: lung hamartomas are composed of cartilage and bronchial tissue.

Lung hamartoma

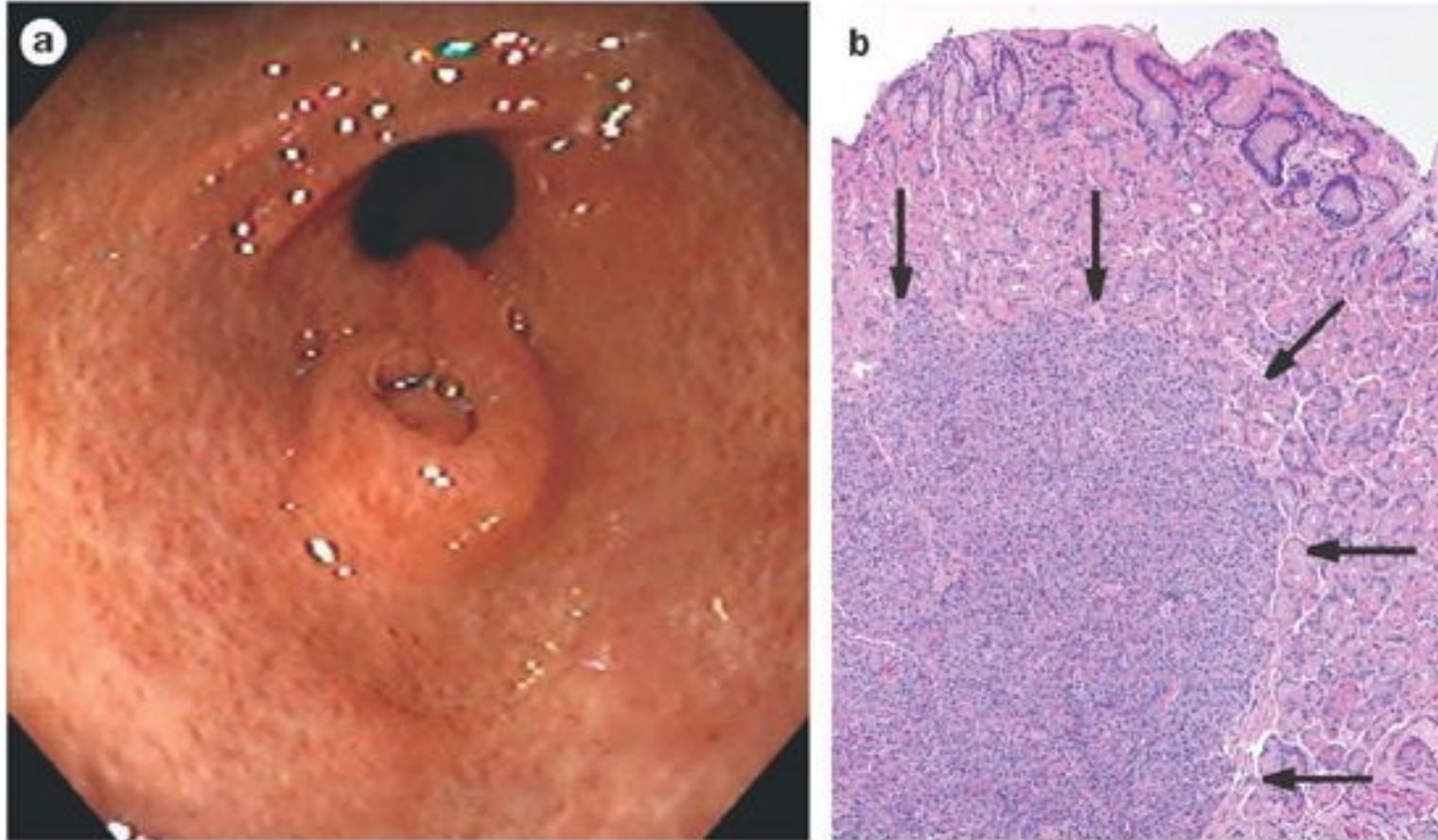


Heterotopias



- These are normal tissue being found in parts of the body where they are not normally present.
- For example: pancreas in the wall of the large intestine.

Heterotopic Pancreas (in the stomach)



Classification of neoplasms



- The primary description of a neoplasm is based on the cell origin and the secondary description is whether it is benign or malignant.

Classification of neoplasms



- For example, tumours of cartilage are either chondromas (if benign) and chondrosarcomas (if malignant.)
- The “chondro” stem means derived from cartilage the suffix “oma” means a benign tumour and the suffix “sarcoma” means a malignant (soft tissue) tumour.

Epithelial neoplasms



Type of epithelium	Benign Tumour	Malignant Tumour	Example(s)
Squamous	Squamous papilloma	Squamous cell carcinoma	Skin, oesophagus, cervix
Glandular	Adenoma	Adenocarcinoma	Breast, colon, pancreas, thyroid
Transitional	Transitional papilloma	Transitional cell carcinoma	Bladder

Connective tissue neoplasms (examples)



Type of connective tissue	Benign Tumour	Malignant Tumour	Example(s)
Smooth muscle	Leiomyoma	Leiomyosarcoma	Uterus, colon
Bone	Osteoma	Osteosarcoma (Osteogenic sarcoma)	Arm, leg

Haematological Neoplasms



Haematological neoplasms	Benign Tumour	Malignant Tumour	Example(s)
Lymphocytes	Extremely uncommon	Lymphoma	Gastric lymphoma
Bone marrow	Extremely uncommon	Leukaemia	Acute lymphoblastic leukaemia, Chronic myeloid leukaemia

Teratomas



- These are tumours derived from germ cells and can contain tissue derive from all three for 3 germ cell layers.
- They may contain mature and / or mature tissue and even cancers.

Teratoma



Malignant tumours with the suffix “oma”



- (Malignant) Lymphoma
- (Malignant) Melanoma
- Hepatoma (better called liver cell cancer)
- Teratoma (not all malignant , see above)

Progress check



Part 1

- The hallmarks of neoplasia

Part 2

- The differences between between benign and malignant neoplasms.

Part 3

- The route by which neoplasms spread.
-

Session Plan



Part 1

- The hallmarks of neoplasia

Part 2

- The differences between between benign and malignant neoplasms.**

Part 3

- The route by which neoplasms spread.

What are the differences between benign and malignant tumours?



- Invasion
- Metastasis
- Differentiation
- Growth pattern

1. Invasion



- This means direct extension into the adjacent connective tissue and /or other structures e.g. blood vessels. This is what distinguishes dysplasia/carcinoma in situ from cancer.

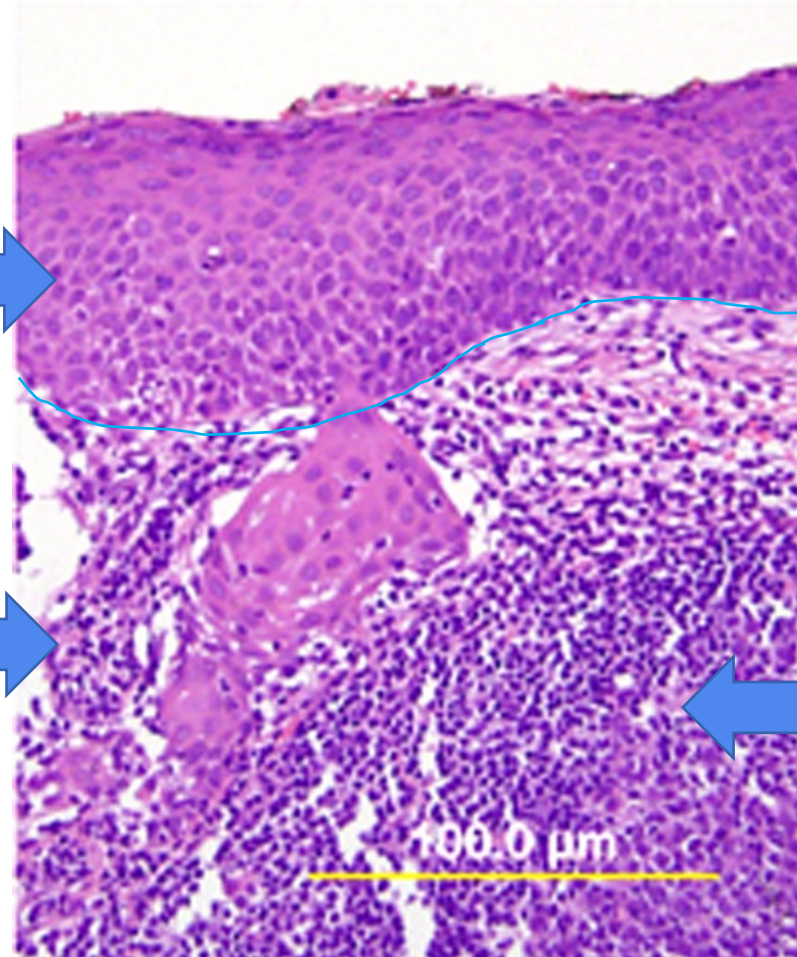
Invasive Squamous Cancer



**Non-
invasive
part**

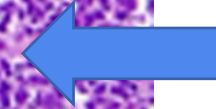


**Invasive
part**



**Basement
Membrane**

Lymphoid
response to
invasive
cancer

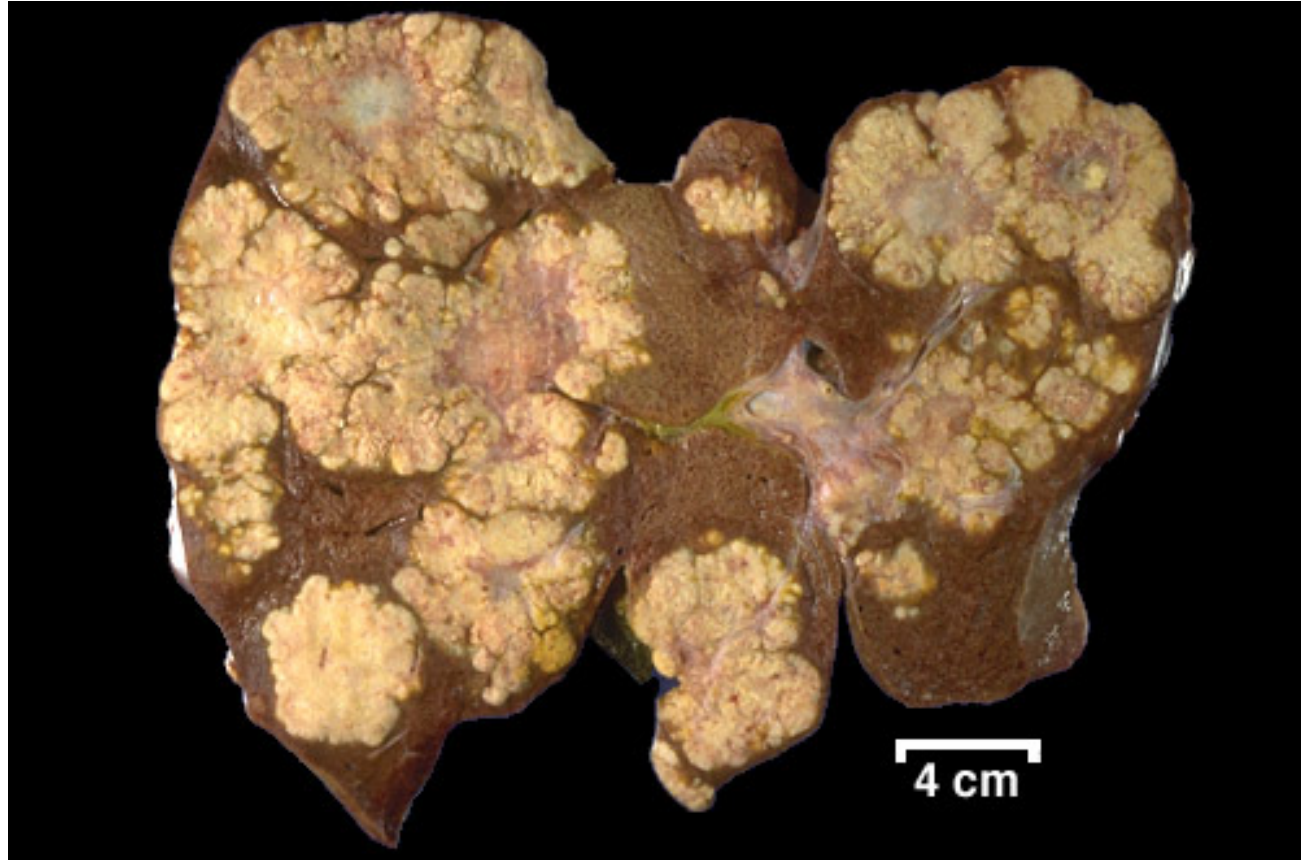


2. Metastasis



- This means spread via blood vessels etc (see below) to other parts of the body.
- NB: All malignant tumours have the capacity to metastasise although they may be diagnosed before they have done so

Liver metastases from a patient with pancreatic cancer

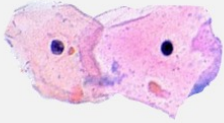

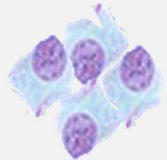
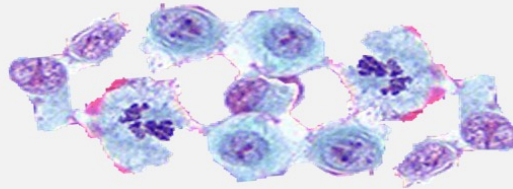
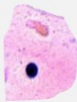
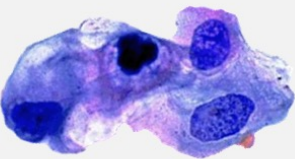
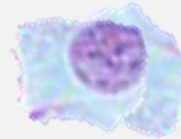
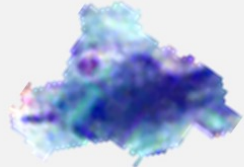


3. Differentiation



- This means how much do the cells of the tumour resemble the cells of the tissue it is derived from.
- Tumour cells tend to have larger nuclei (and hence a higher nuclear-cytoplasmic ratio) and more mitoses than the normal tissue they are derived from.
- They may have abnormal mitoses (e.g. tripolar) and marked nuclear pleomorphism (variability in nuclear size and shape).



Normal	Cancer	
		Large, variably shaped nuclei
		Many dividing cells; Disorganized arrangement
		Variation in size and shape
		Loss of normal features

4. Growth pattern








- This means how much does the architecture of the tumour resembles the architecture of the tissue it is derived from.
- Tumours have less well defined architecture than the tissue they are derived from.

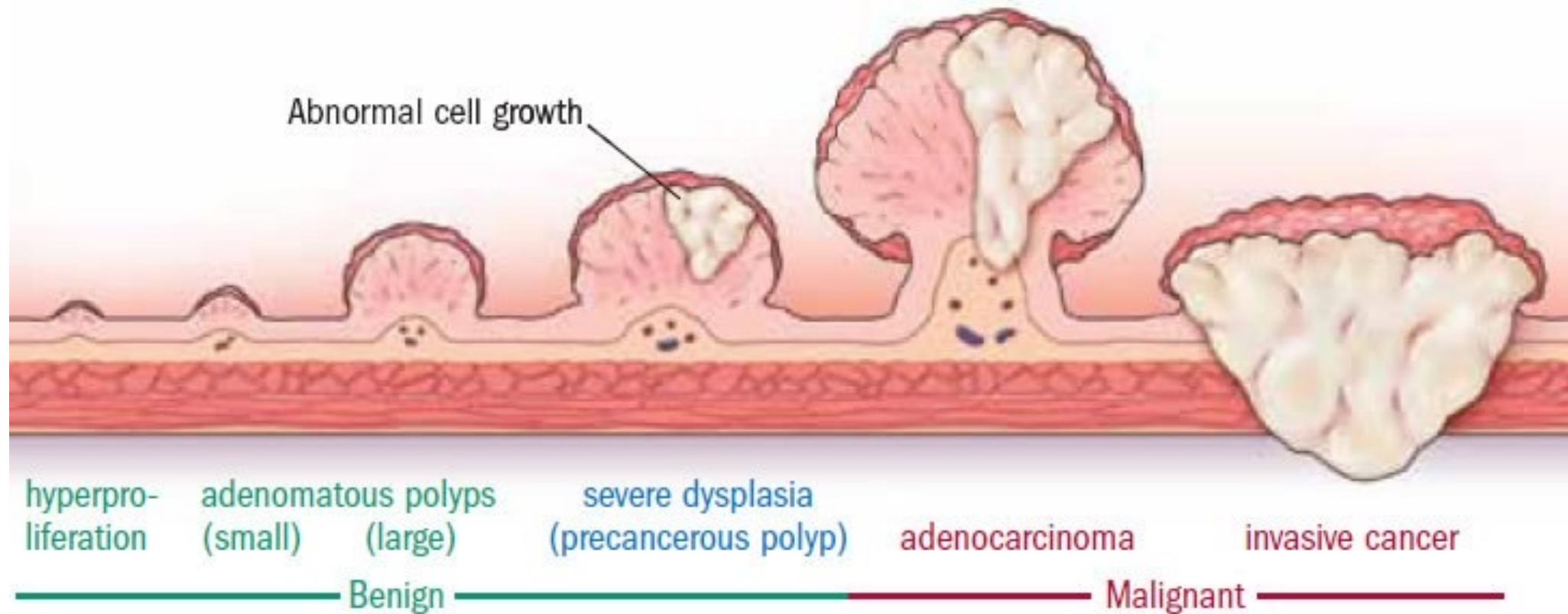


Gleason Grading System

The Gleason Grading System is used to evaluate or "grade" prostate cancer cells obtained by needle biopsy. The cells are assigned a number between 1 and 5 — nearly normal cells are Grade 1 and the most abnormal are Grade 5. Then the scores of the two most common cell patterns are added together. Gleason scores range from 2 to 10. The higher the grade, the more aggressive the cancer.

	1 Simple round glands, closely packed in rounded masses with well-defined edges.
	2 Simple round glands, loosely packed in vague, rounded masses with loosely defined edges.
	3A Medium-sized single glands of irregular shape and irregular spacing with ill-defined infiltrating edges. 3B Very similar to 3A, but small to very small glands which must not form significant chains or cords. 3C Papillary and cribriform epithelium in smooth, rounded cylinders and masses; no necrosis.
	4A Small, medium, or large glands fused into cords, chains, or ragged, infiltrating masses. 4B Very similar to 4A, but with many large clear cells, sometimes resembling "hypernephroma."
	5A No glandular differentiation, solid sheets, cords, single cells, or solid nests of tumor with central necrosis. 5B Anaplastic adenocarcinoma in ragged sheets.

Benign tumours may become malignant



Progress check



Part 1

- The hallmarks of neoplasia

Part 2

- The differences between between benign and malignant neoplasms.

Part 3

- The route by which neoplasms spread.

Session Plan



Part 1

- The hallmarks of neoplasia

Part 2

- The differences between between benign and malignant neoplasms.

Part 3

- The route by which neoplasms spread.

By which routes do tumours spread?



- Direct extension.
- Haematogenous.
- Lymphatic
- Transcoelomic
- Perineural

1. Direct extension.

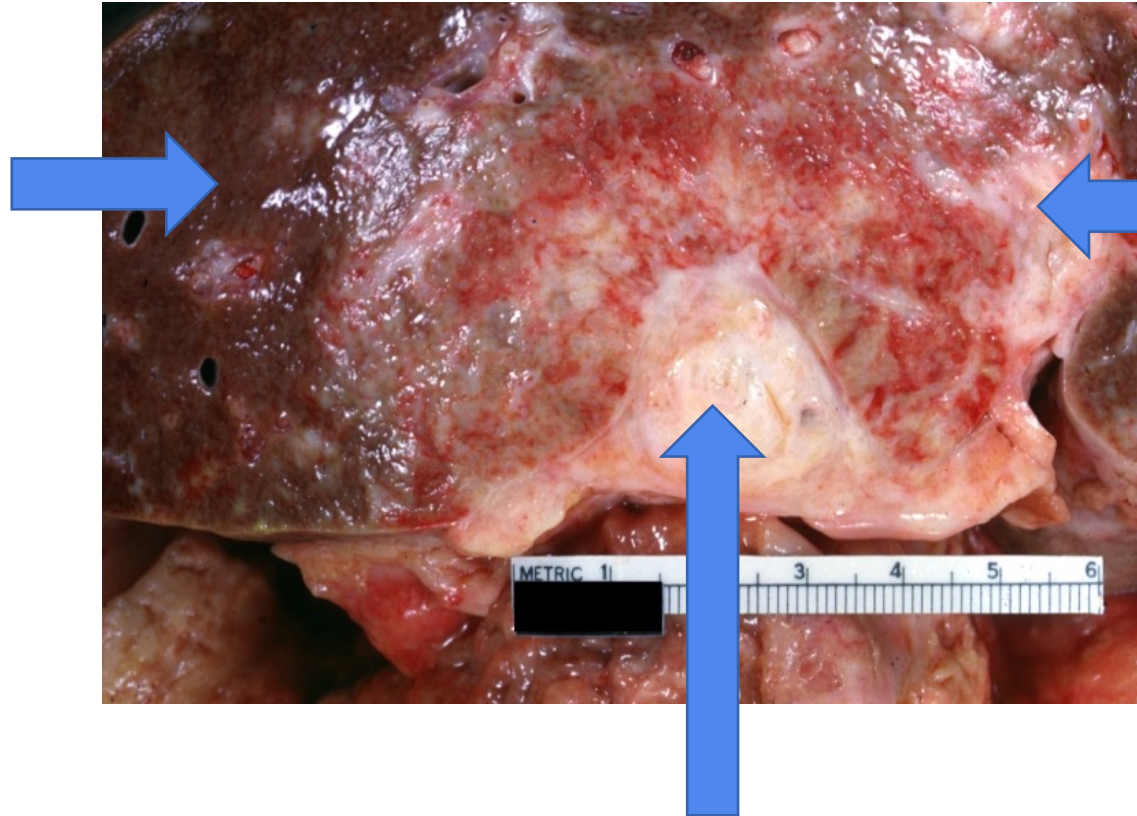


- This is associated with a stromal response to the tumour.
- This includes fibroblastic proliferation (“a desmoplastic response”), vascular proliferation (angiogenesis) and an immune response.

Gall bladder cancer invading liver



Normal
liver



Gall
bladder
cancer
invading
liver

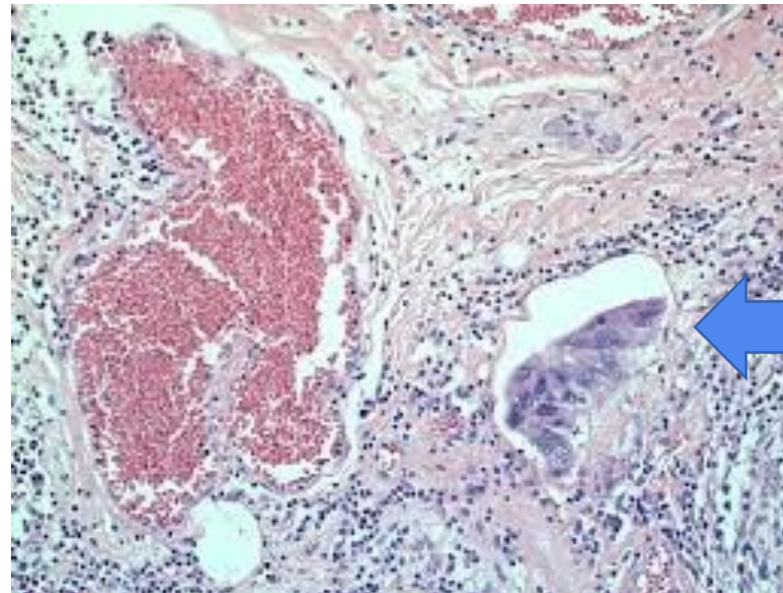
Gall bladder cancer

2. Haematogenous



- This is via blood vessels.
- The blood vessels usually invaded are the venules and capillaries because they have thinner walls.
- Most sarcomas metastasise first via the blood vessels.

Vascular invasion



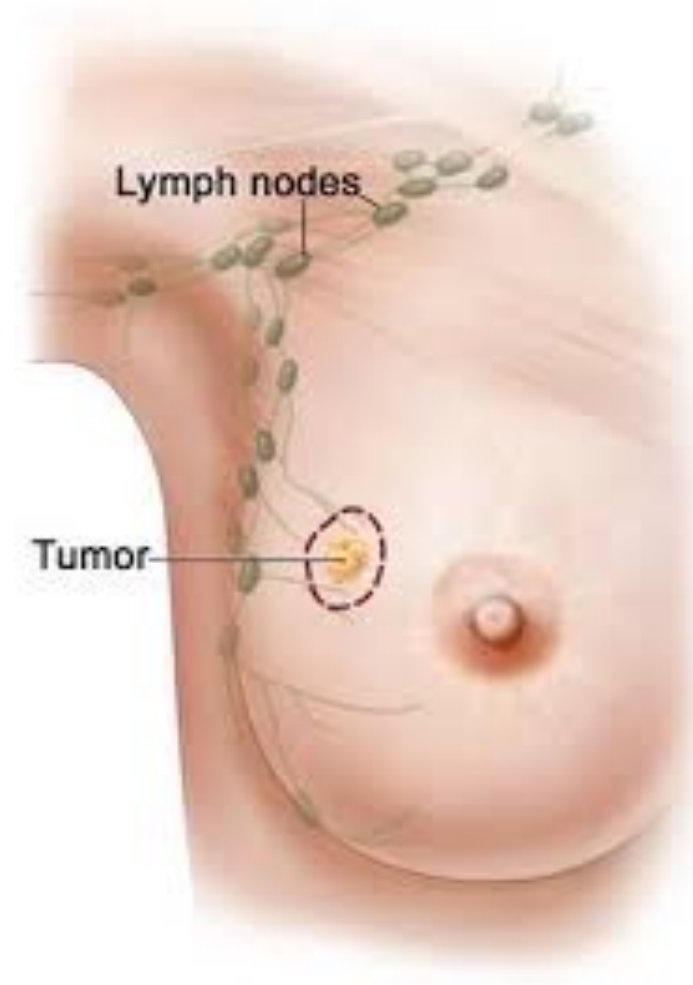
Tumour in
blood
vessel

3. Lymphatic



- This is via lymphatics to lymph nodes and beyond.
- The pattern of spread is dictated by the normal lymphatic drainage of the organ in question.
- Most epithelial cancers metastasise first via the lymphatics.

Lymphatic spread to axillary nodes from breast cancer

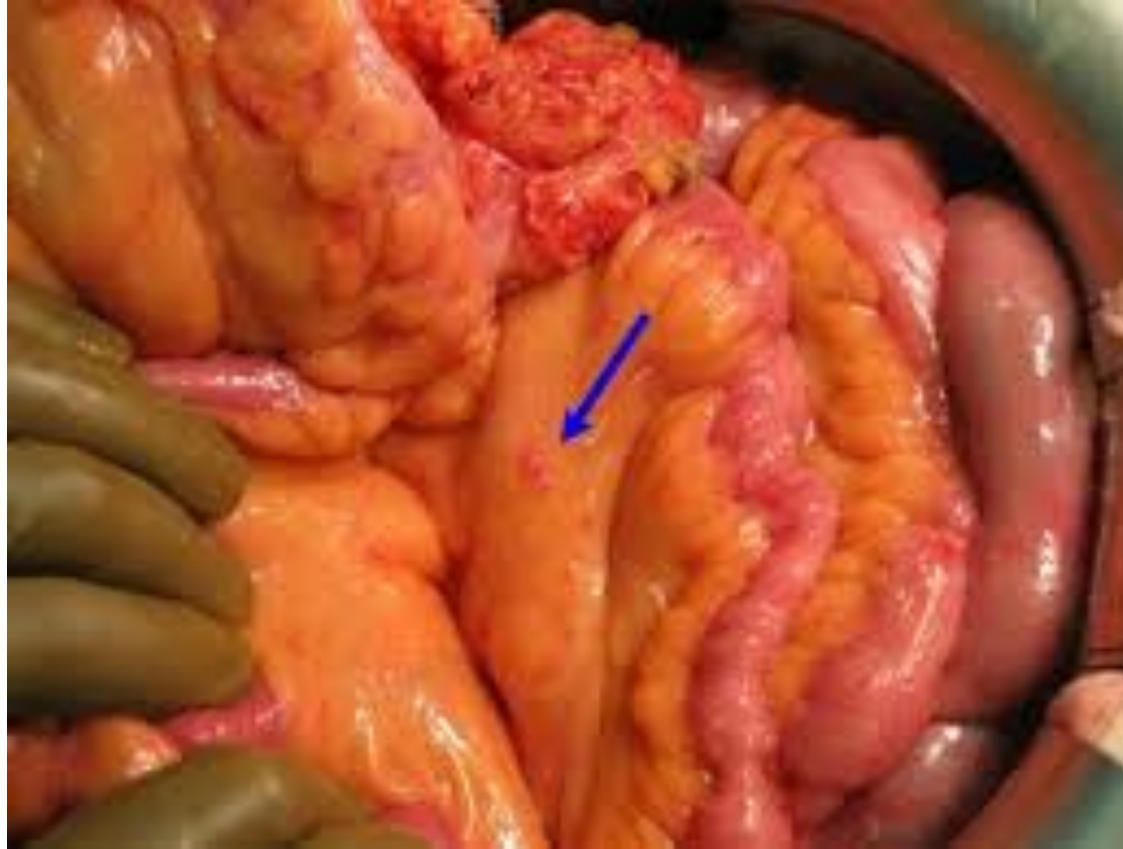


4. Transcoelomic



- This is via seeding of body cavities.
- The commonest examples are the pleural cavities (for intrathoracic cancers) and the peritoneal cavities (for intra-abdominal cancers)

Peritoneal spread from gastric cancer

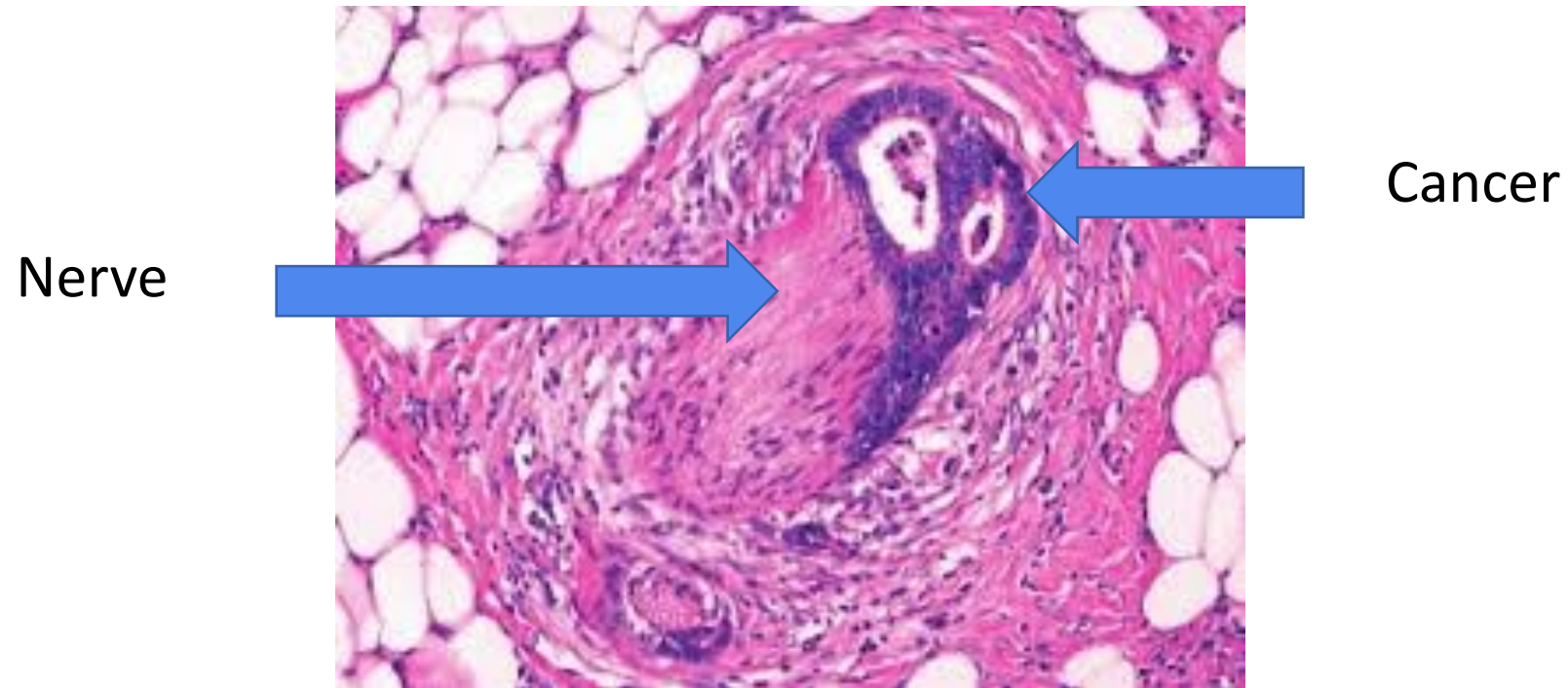


5. Perineural



- This is via nerves.
- This is an underappreciated route of cancer spread.

Perineural invasion



How do we assess tumour spread?



1. Clinically
2. Radiologically
3. Pathologically

How do we describe tumour spread (stage)?

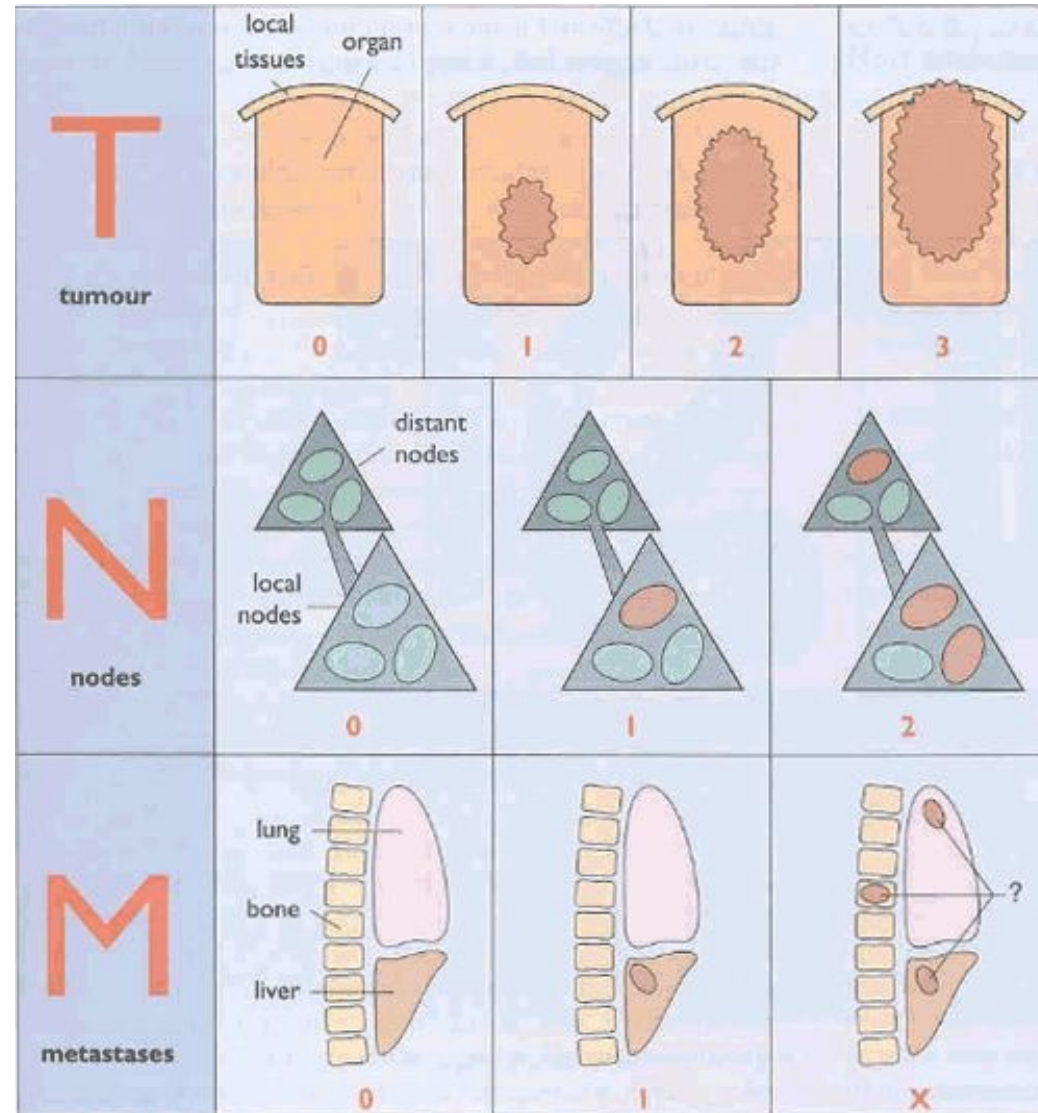


T = Tumour: the tumour size or extent of local invasion

N = Nodes: number of lymph nodes involved

M = Metastases: presence of distant metastases

This is called the “**TNM**” system and the details are different for each kind of cancer



Grade and Stage



- **Grade** = how differentiated is the tumour (see Differentiation, above)?
- **Stage** = how far as the tumour spread (see TNM above)?
- **In terms of tumour prognosis, Stage is more important than Grade.**

Progress check



Part 1

- The hallmarks of neoplasia

Part 2

- The differences between between benign and malignant neoplasms.

Part 3

- The route by which neoplasms spread.