



BIOCHEMISTRY OF CANCER AND ASSOCIATED BIOCHEMICAL MARKERS I

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Advance Clinical Biochemistry II (MA 406)

Summer Semester

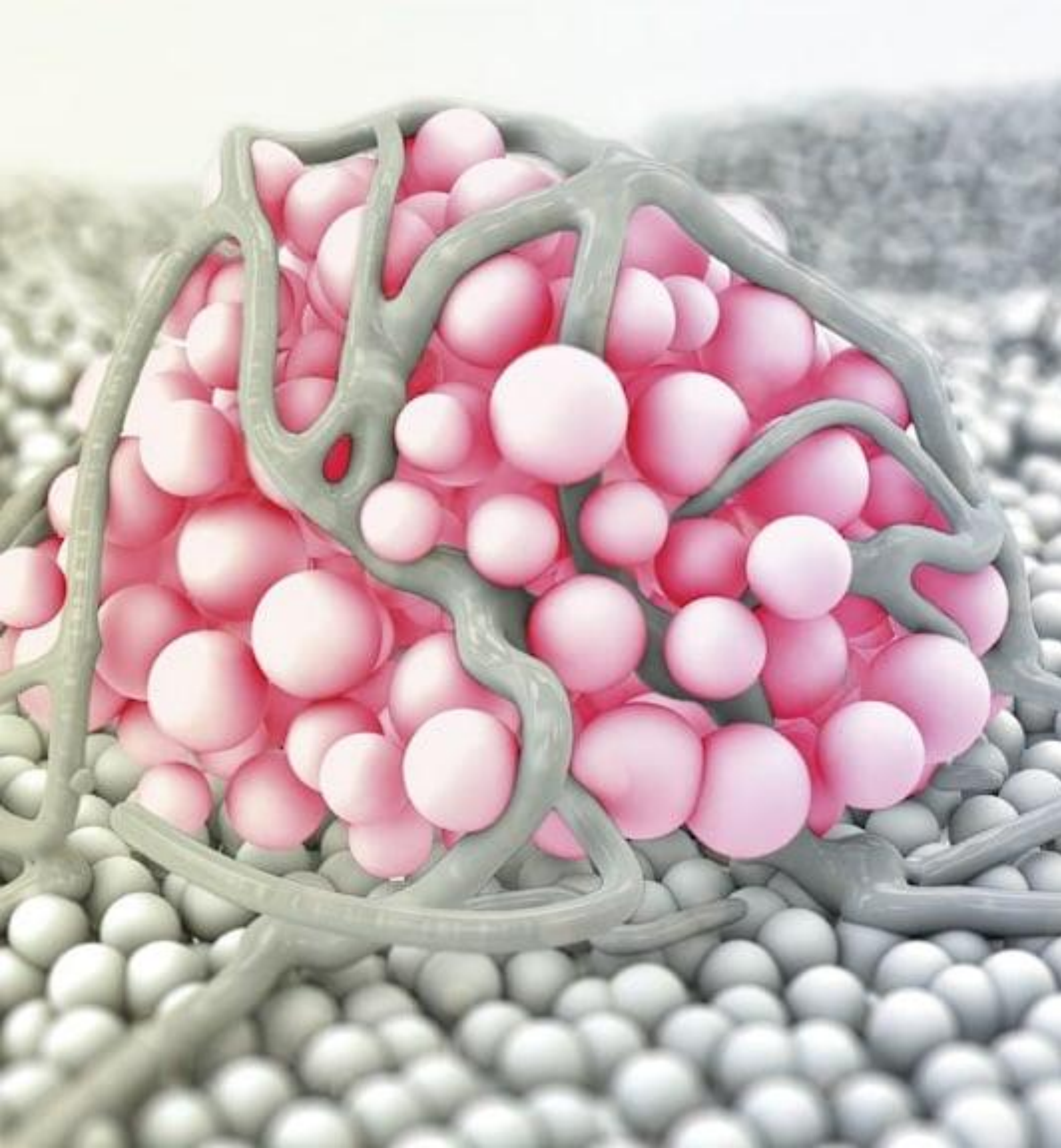
Lecture Seven

31/08/2026



Learning Objectives

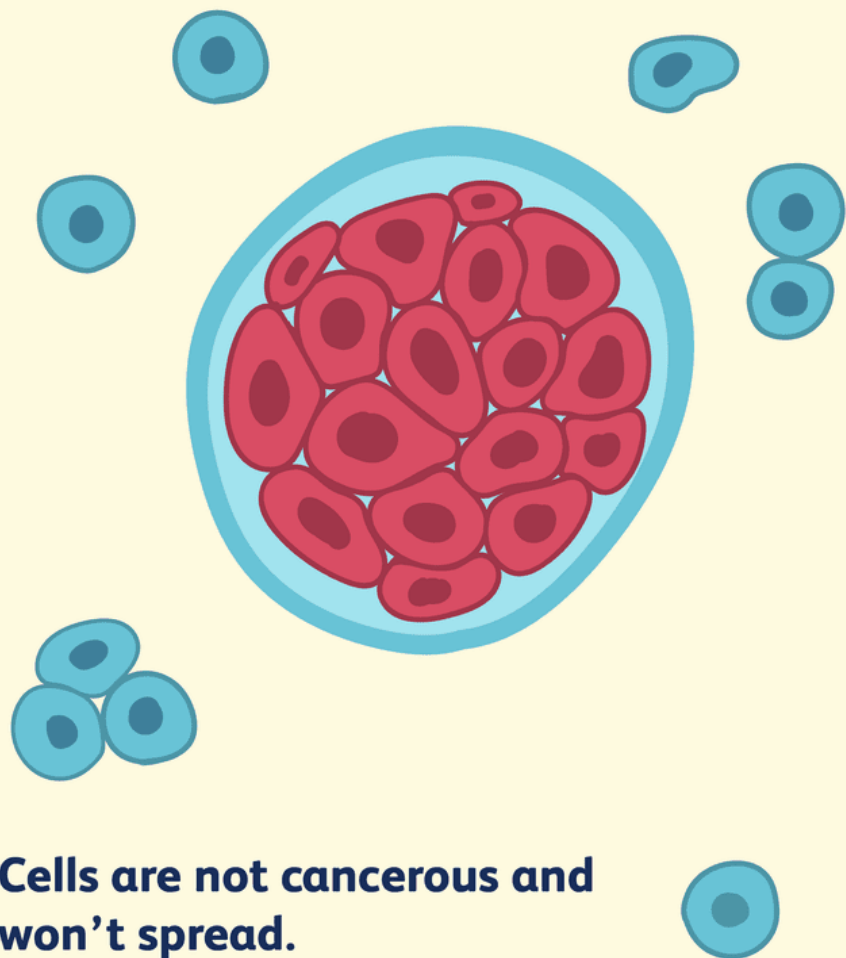
- Students are to understand:
- Tumour and its types
- The hallmark of malignancy
- The clinical circumstances to request tumor markers
- The routine tumor markers and
- the limitations of such measurements



Introduction

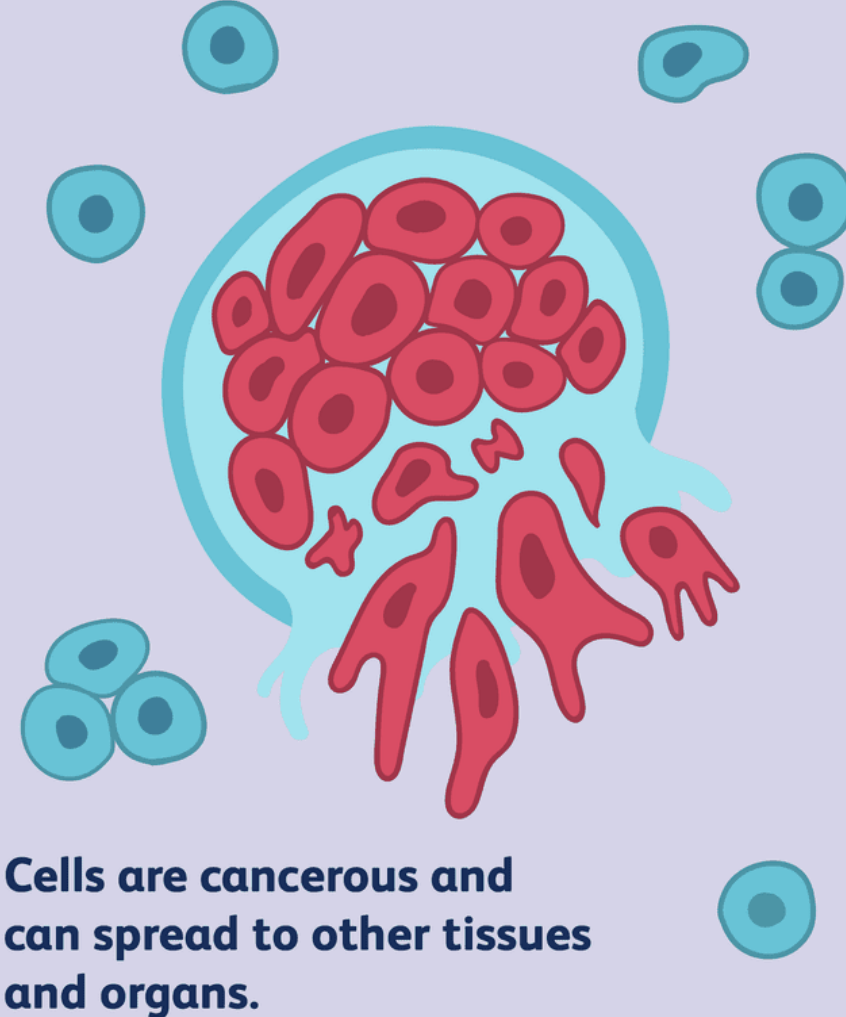
- **Tumour:** It is an abnormal mass of tissue that forms when cells grow and divide uncontrollably.
- **Types of Tumour:**
 - benign (not cancer) or malignant (cancer).
- **Hallmark of tumour:**
 - It constitutes an organizing principle for rationalizing the complexities of neoplastic disease.

Benign Tumor



Cells are not cancerous and won't spread.

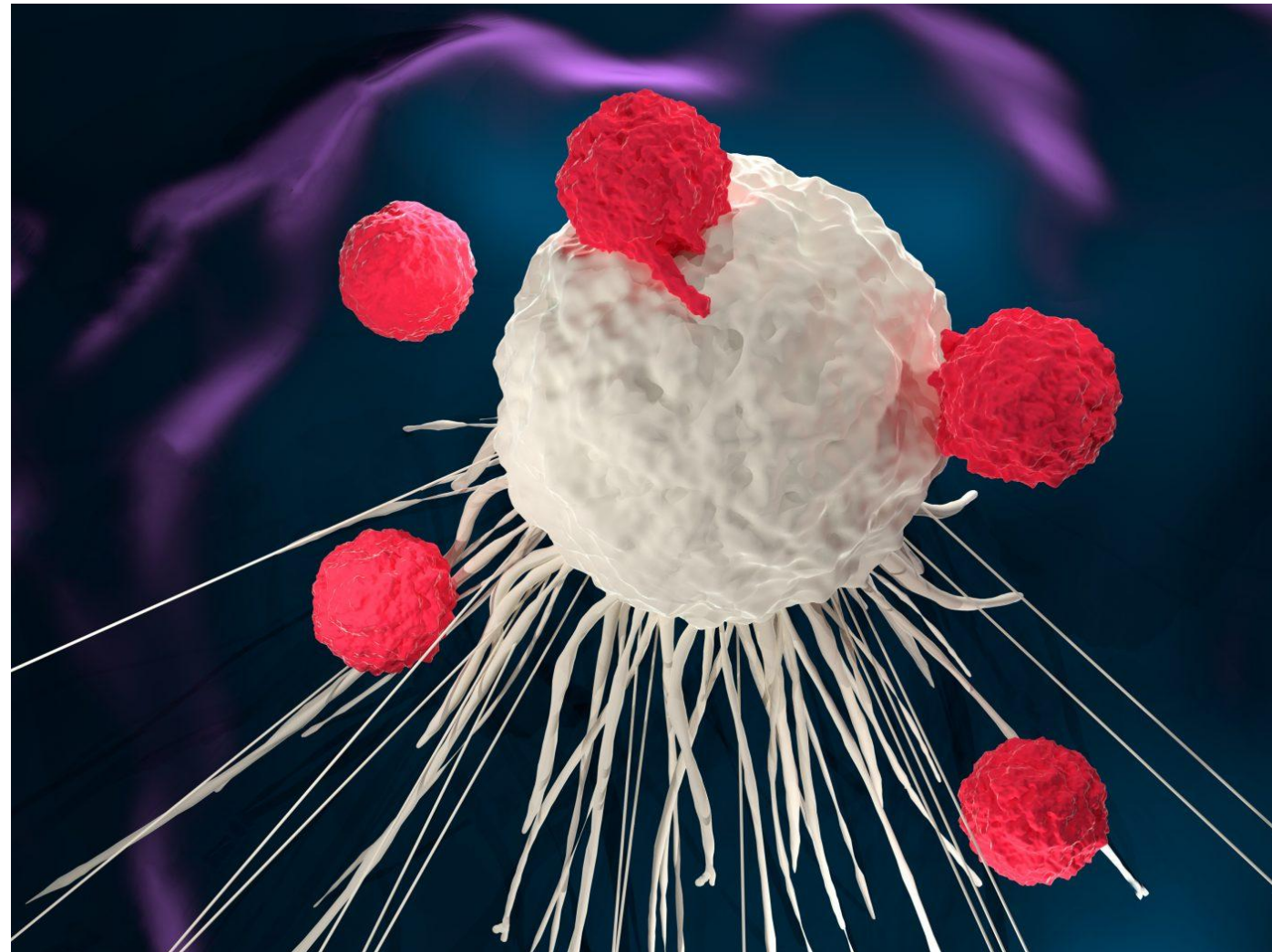
Malignant Tumor



Cells are cancerous and can spread to other tissues and organs.

Cont.

- Benign tumours may grow large spreading or invading nearby tissues or body parts.
- Tumours may secrete a wide range of substances into blood (hormones, enzymes and antigens), known as tumour markers.
- Tumour marker measurements can contribute to patient management in a number of ways.



Cont.

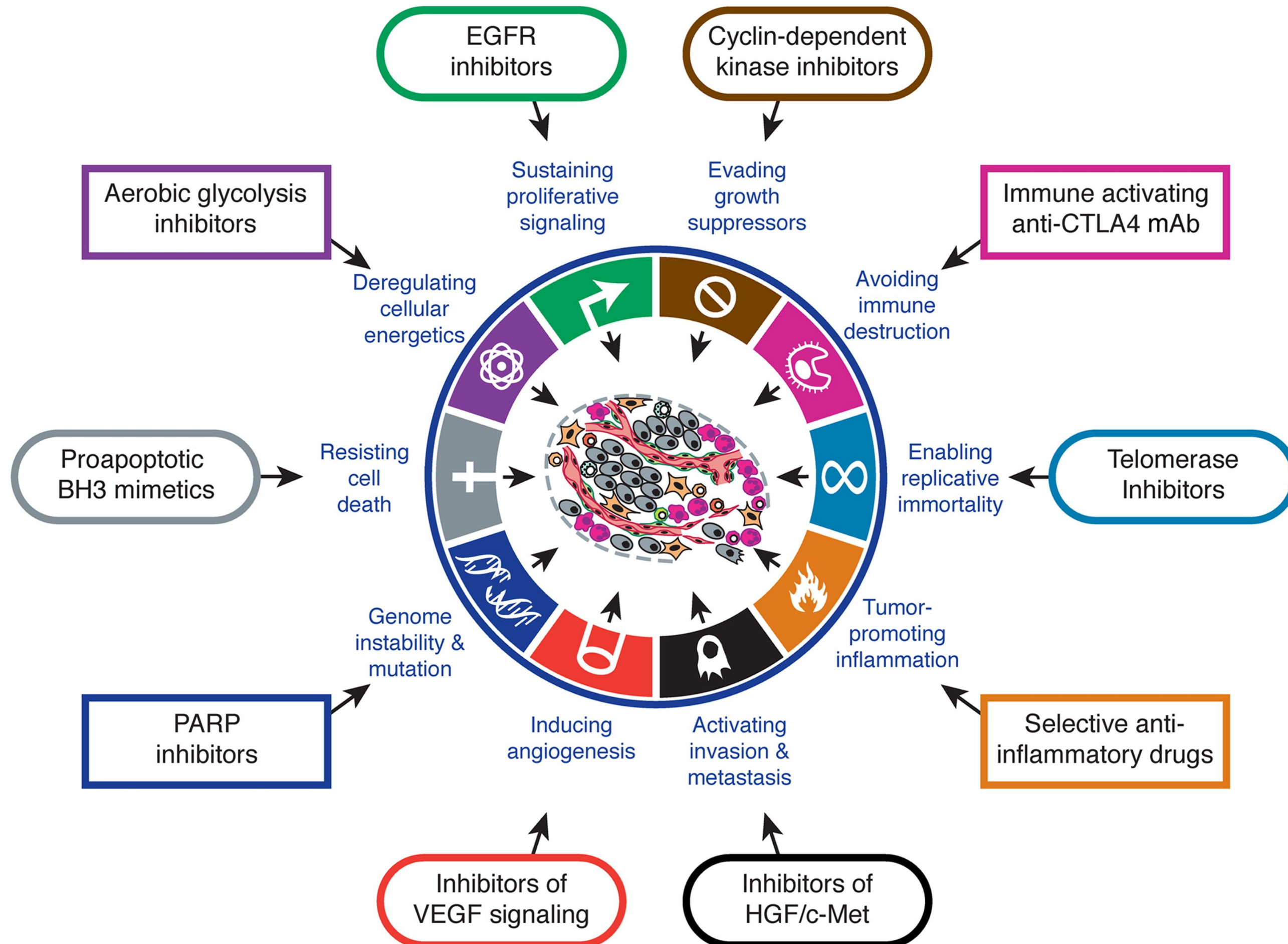
- When interpreting the results of serum tumour markers it is essential to remember the following:
- Concentrations within the reference range do not exclude malignancy.
- A rise in concentration within the reference range should raise the suspicion of tumour recurrence in previously diagnosed patients.
- Nonmalignant conditions may increase the concentration of some tumour markers.



Cont.

- Care must be taken when requesting for tumour markers.
- Inappropriate requests can lead to unnecessary investigations, with the potential risk of harm (e.g. biopsy) and considerable patient anxiety.
- The screening of nonspecifically unwell patients with panels of tumour markers should be discouraged.
- This is due to the low diagnostic sensitivity and specificity under such circumstances.

Influencers of Cancerous Cells





Tumour markers commonly used in clinical practice

- A tumor marker is anything present in or produced by cancer cells or other cells of the body.
- The marker could be produced in response to cancer or certain benign conditions.
- They provide information about a cancer, such as how aggressive it is, whether it can be treated with a targeted therapy, or whether it is responding to treatment.

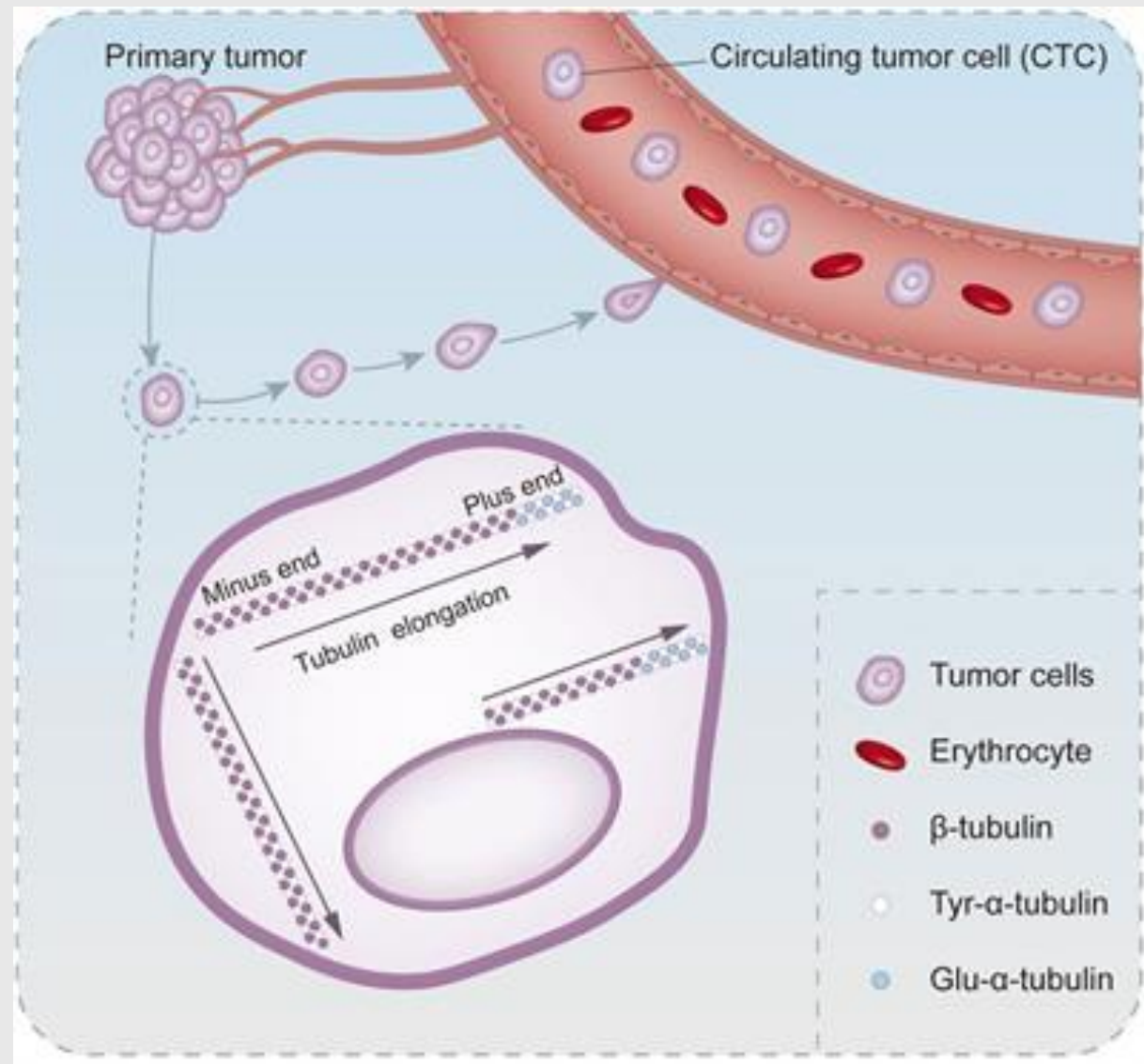


Carcinoembryonic antigen (CEA)

- CEA is a high molecular weight glycoprotein, and its measurement remains the most widely used marker.
- It aid in the prognosis, surveillance and monitoring of patients with colorectal cancer.
- CEA measurements appear to define cancer patients that have poor prognosis and could benefit from adjuvant chemotherapy.
- CEA levels should return to normal post-operatively following successful surgical resection, failure to do so suggests residual or metastatic disease.

Cont.

- Serial monitoring with CEA can detect recurrent disease with a sensitivity of approximately 80% and specificity of approximately 70%.
- Patients monitored frequently with CEA have an improved 5-year survival rate.
- CEA testing is often carried out every 2–3 months for at least 3 years after the initial diagnosis.





Carcinoembry antigen

CEA test

Cont.

- Monitoring the response to chemotherapy using CEA is also desirable, with measurements being taken every 2–3 months of active treatment.
- Smaller but persistent incremental rises in CEA should also prompt further investigation.
- Significant percentage of patients with early colorectal cancer have elevated CEA.



Cancer antigen 125 (CA-125)

- CA-125 is a high molecular weight glycoprotein that has a well-defined role in the screening and monitoring of ovarian carcinoma.
- The majority of ovarian cancers are diagnosed in women >45 years, with the highest rates in the 60–64 year age group.
- The CA-125 is found on the endothelium of the fallopian tubes, endocervix and endometrium.



Cont.

- Serum CA-125 is elevated when there is vascular invasion, tissue destruction and inflammation associated with malignancy.
- It is increased in over 90% of women with advanced ovarian cancer disease and in 40% of patients with advanced abdominal malignancy.
- However, serum CA-125 can also be increased during menstruation and pregnancy.
- Values in patients with ascites can be particularly high, regardless of whether malignancy is present or not.



Cont.

- National Institute for Health and Excellence (NICE) in UK recommends that serum CA-125 in women with persistent symptoms should be measured.
- If the CA-125 conc. is >35 kU/L, pelvis and abdomen ultrasound should be performed, and calculate the risk of malignancy index (RMI).
- Patients who have a score >250 kU/L should be referred for specialist investigation.

CA 125

- 1 Ovarian cancer
- 2 Adenocarcinoma of cervix
- 3 Endometrium adenocarcinoma
- 4 GIT carcinoma
- 5 Breast cancer

Cont.

- Important points:
- CA-125 is only elevated in 50% of cases in stage 1 of ovarian cancer.
- Result within the ref. range shouldn't be used to exclude ovarian cancer.
- Rise in CA-125 is not only due to malignancy (pre-menopausal women).
- Rise in CA-125 due to ovarian malignancy increases with age.
- CA-125 is a reliable marker of response to treatment and progression.



Prostate-specific antigen (PSA)

- PSA is a glycoprotein used as a tumour marker to aid diagnosis and to monitor patients with prostatic cancer.
- PSA is detectable in the serum of healthy men and the concentration rises with age; thus age-related reference ranges are useful.
- Most PSA circulates in plasma bound to α 1-antichymotrypsin, but a small fraction circulates unbound to any protein (free PSA).
- Patients with prostate cancer have higher ratio of bound and free PSA than patients with benign hypertrophy.



☐ Important points on PSA

- Approximately 50% of men with prostatic cancer who have a PSA between 4 and 10 $\mu\text{g/L}$ will have severe disease.
- Approximately 15% of patients diagnosed with prostatic malignancy will have a PSA between 3 and 4 $\mu\text{g/L}$.
- Bone metastases are unlikely in patients with a PSA below 4 $\mu\text{g/L}$.



Cont.

- The value of screening asymptomatic patients remains controversial.
- If performed, screening should only be done after appropriate counseling.
- Studies indicate that the 10-year survival rates for males with early-stage prostate cancer detected by PSA testing
- That does not differ between those given treatment and those that undergo active monitoring.

Summar

- ❖ Tumours can be benign or malignant, and malignant tumours are associated with cancer.
- ❖ The hallmarks of Malignancy aid in understanding neoplastic disease complexity.
- ❖ Tumour Markers are substances (e.g., hormones, enzymes, antigens) secreted by tumours; used for diagnosis, prognosis, monitoring, and recurrence detection.
- ❖ CEA (Carcinoembryonic Antigen) is used in colorectal cancer. Monitors treatment and detects recurrence.
- ❖ CA-125 is used in ovarian cancer. Limited by nonspecific elevations (e.g., menstruation, pregnancy).
- ❖ PSA (Prostate-Specific Antigen) is used to monitor prostate cancer. The interpretation is influenced by age and benign conditions.
- ❖ Elevated markers $\neq$ of cancer may also rise in benign conditions.
- ❖ Normal levels do not rule out malignancy.
- ❖ Use markers selectively to avoid unnecessary investigations and anxiety.
- ❖ Follow NICE and other clinical guidelines for marker-based screening.



Next Lesson!

Biochemistry of Cancer and Its Associated Biomarkers II



Questions

Comments

Feedback