

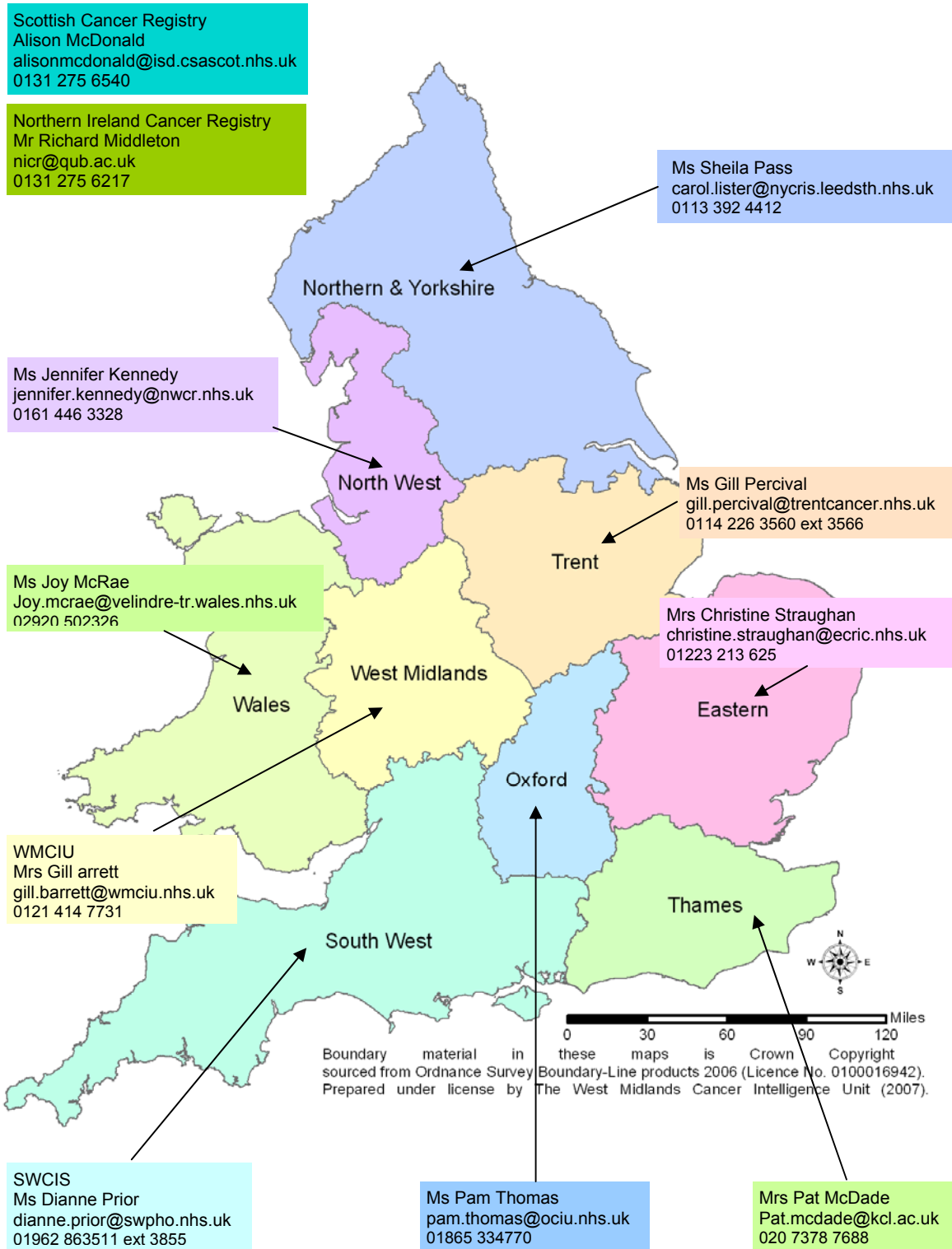
MDT Co-ordinators  
Information Pack



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## Cancer Registry Contacts for MDT co-ordinators



# Cancer registration

## What is cancer registration?

Cancer registration is the process of maintaining a systematic collection of data on the occurrence and characteristics of malignant neoplasms (in situ and invasive cancers) and certain non-malignant tumours. The procedure is widely established throughout the world and generally follows guidelines established by bodies such as the International Union Against Cancer (UICC), the International Agency for Research on Cancer (IARC), the International Association of Cancer Registries (IACR), and the World Health Organisation (WHO).

Cancer registries are unique in being able to provide adequate historical trend and population-based data to monitor changes in cancer incidence or survival over long periods of time. Regional cancer registries across the UK have been collecting population-based cancer data for the past 40 years. The Office for National Statistics (ONS) began collating data from the regional registries in England and Wales during the early 1960s, for the provision of national cancer statistics. The ONS still collates data from all the English registries but Northern Ireland, Scotland and Wales each have just one, national, cancer registry.

There are three main types of cancer registry. Hospital cancer registries take account only of patients attending a particular hospital and are used principally to assist in clinical management, for example by facilitating the recall of patients at appropriate intervals, and in clinical research. Population-based cancer registries cover all cases of cancer in defined populations. Finally, specialist registries may cover only cases of particular tumours or people in a specified age range, for example that maintained by the Childhood Cancer Research Group (CCRG) in Oxford which includes children up to the age of 15. No cancer register elsewhere covers as large a population as England and Wales. Together with Scotland and Northern Ireland, the system of registration covering the whole of the UK is without parallel in the world.

## How is cancer registration organised in the UK?

The UK is widely acknowledged as having one of the most comprehensive cancer registration systems in the world. There are currently 11 cancer registries in the UK, each covering populations of between approximately 2.3 and 11.8 million people. Cancer registration in England is conducted by eight regional registries, which submit a standard dataset of information to the Office for National Statistics (ONS), for the collation of national cancer incidence data. Northern Ireland, Scotland and Wales each have one, national, cancer registry.

Although changes in health geography, including the introduction of cancer networks in response to the Calman-Hine report for commissioning cancer services, have led to some cross-boundary issues for the English registries, the registries still provide complete coverage of the UK for the collection of population-based cancer data.

## Where do registries get the information from?

The information is acquired from a variety of sources including hospitals, cancer centres, treatment centres, hospices, private hospitals, cancer screening programmes, other cancer registers, general practices, nursing homes and death certificates. In many instances, more than one source of information is available to cancer registries from a single organisation, for example hospital patient information systems (PAS), pathology laboratories, medical records departments and radiotherapy databases.

Cancer registries are working towards receiving all data electronically and increasingly, MDT co-ordinators are being identified as being an extremely good source of complete and accurate information. MDT co-ordinators are recording data derived from the MDT meetings. Most of this data is required for the National Cancer Dataset or various other audit databases such as LUCADA and DAHNO anyway, and it is envisaged that this data can be downloaded to cancer registries to ensure complete and timely data at the registries.

## What is cancer registration information used for?

As the only available source of reliable, population-based information on cancer incidence, prevalence and survival rates, cancer registries have an essential role in the implementation and monitoring of key national initiatives such as the *NHS Cancer Plan in England and Cancer in Scotland: Action for Change*, which aim to improve the quality of care and survival prospects for cancer patients.

Cancer registries also undertake a range of public health surveillance and health protection functions, with cancer registration information being specifically used to:-

- Monitor trends in cancer incidence, prevalence and survival with time and among different areas and social groups.
- Evaluate the effectiveness of cancer prevention and screening programmes. For example, population-based data are required to monitor the effectiveness of the existing NHS Cancer Screening Programmes for breast and cervical cancer and to assist in the design of new programmes (e.g. screening for bowel cancer).
- Evaluate the quality and outcomes of cancer care, through the provision of comparative data about treatment patterns and outcomes.
- Evaluate the effect of environmental and social factors on cancer risk and support other investigations into the causes of cancer. Cancer registration information is currently being used, for example, to investigate cancer risks in relation to power lines, landfill sites and mobile phone masts.
- Investigate differences in cancer incidence, survival and access to treatment among social groups and thus contribute to programmes aimed at reducing inequalities in health outcomes.
- Support the work of cancer genetic counselling services for individuals and families who have a higher risk of developing cancer.

- Support recalls of specific groups of cancer patients, for example women who were treated for Hodgkin's disease with radiotherapy and may have an increased risk of developing breast cancer.

Cancer registries are also working to improve how they can inform the provision and effectiveness of local cancer services through collaborative projects with other organisations such as cancer networks, primary care trusts, strategic health authorities, public health observatories and the Health Protection Agency, and by consulting with potential users.

## Cases requiring registration

All malignant, in situ, uncertain tumours and all benign tumours of the brain and central nervous system require registration at cancer registries.

The recognised coding classification system for the site of a neoplasm, used throughout the UK in NHS hospitals, is the International Classification of Diseases (ICD10). The range of codes being the 'C' and 'D' chapters.

ICD10 Code	Description
C00 – C97	All malignant neoplasms
D00 – D09	<i>In situ</i> neoplasms
D32 – D33	All benign neoplasms of CNS
D35.2 – D35.3	Benign neoplasms of pituitary gland and craniopharyngeal duct
D35.4	Benign neoplasms of pineal gland
D37 – D48	Uncertain behaviour neoplasms

## Data recorded by cancer registries

All registries collect a common minimum dataset of information. Cancer registries in England are also required to collect the cancer registration items from the new National Cancer Dataset, which has been formally agreed and published in Dataset Change Notice (DSCN) 2005/09.

## Data items collected

1. Administration details
2. Patient demographics
3. Tumour details
4. Treatment modality
5. Death details
6. Additional optional data



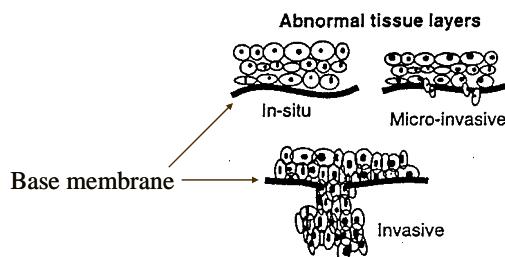
# The pathology of cancer

## How cancer develops

All the tissues in the body are made up of trillions of structural units called cells. Cells carry out all kinds of functions of life such as the beating of the heart, breathing, digestion, thinking, walking, and so on. However, all of these functions can only be carried out by normal healthy cells. Some cells stop functioning or behaving as they should, serving no useful purpose in the body at all, and become cancerous cells.

Normal, healthy cells constantly divide, increasing in number and replacing themselves due to wear and tear or damage, one cell becomes two, the two become four, and so on. When enough cells have been produced for a particular purpose this dividing mechanism switches off naturally, for example, when you cut your finger, certain cells divide rapidly until the tissue is healed and the skin is repaired. They will then go back to their normal rate of division. Normal cells often have a limited life span and are pre-programmed to die when they are too old or if they start malfunctioning. This process is called **apoptosis**.

Cancer cells ignore the messages that would normally tell them to stop dividing and begin dividing in a haphazard way, becoming a non-structured mass or tumour. *Uncontrolled growth does not always produce a malignant tumour as cells can 'heap up', such as a wart on the skin, which is a benign tumour.*



## Behaviour or invasiveness of a tumour

Although some tumours may become quite large, they will remain encapsulated and do not have the ability spread to other regions of the body, and therefore do not usually pose a risk to life. However some tumours do have the ability to destroy the part of the body in which they originate and then spread to other parts where they are said to **metastasise**.

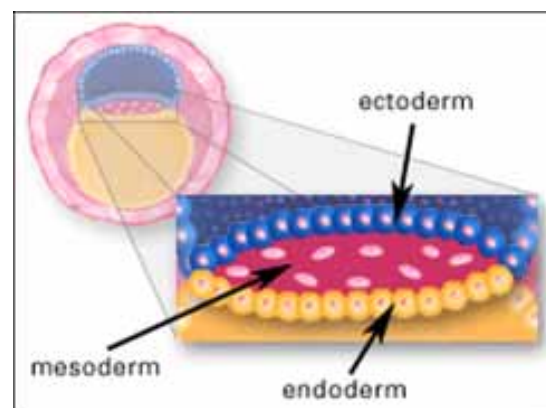
*Note: Cancer registries record all benign tumours of the Brain and CNS as these tumours can still cause death because of the area of the body they are pressing on.*



## Differentiation

Differentiation describes the process by which cells acquire a particular structure. The morphology of a cell may change dramatically during differentiation, but the genetic material remains the same.

The body tissues and organs develop from the three primary germ layers that form during the growth process of the human embryo.



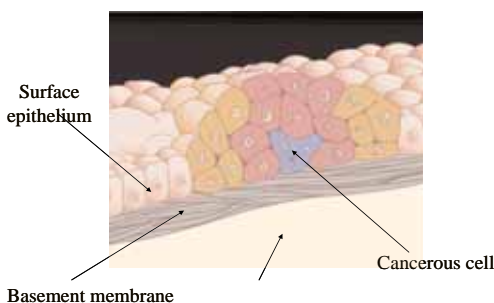
Cells can be grouped together or classified according to the job that they do, or the type of body tissues that they make up. The main tissue types are:

- **Epithelial tissue** – skin, lining of digestive system
  - carcinomas
- **Connective tissue** – muscles, tendons, fat, soft tissue and bones
  - Sarcomas
- **Neural tissue** – brain and CNS
  - Gliomas / Astrocytomas

Malignancies arising in epithelial cells are called carcinomas and account for about 85% of all malignancy types. Epithelial tissue is found in areas of the body where the tissues are protective or secretory, e.g. skin or digestive tract, and contain a **basement membrane**.

### ***In situ carcinoma / non invasive carcinoma / intraepithelial carcinoma***

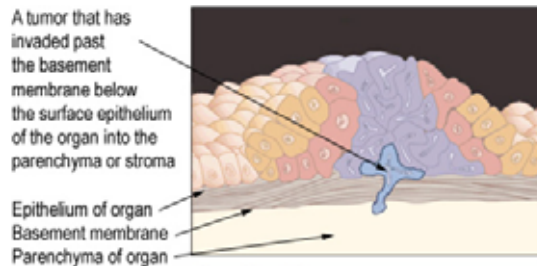
Abnormal cells increase in number and form an expanding focus, which is enclosed within the normal confines of the epithelium. As long as the focus is confined to the epithelium (above the basement membrane), it cannot invade and spread as there are no blood or lymphatic vessels in this tissue.



Picture courtesy of SEER

### ***Invasive carcinoma***

A variable proportion of *in situ* lesions will eventually break through the **basement membrane** of the epithelium and spread into the surrounding tissues. The carcinoma cells now have the ability to invade local tissues and to disseminate or metastasise via lymphatics or blood.



Picture courtesy of SEER

### ***Local invasion***

Spread by local involvement of surrounding tissue is caused by cells infiltrating along lines of least resistance. For example, cancer cells will not invade into bone, which is difficult to invade, if there is the possibility of invading into other softer tissue.

### ***Metastatic / secondary tumours***

Distant metastases are tumour cells that have broken away from the primary tumour and formed as distant growth in a different organ. Metastases may also be referred to as diffuse, disseminated, metastatic, secondary disease or carcinomatosis.

### ***Lymphatic spread***

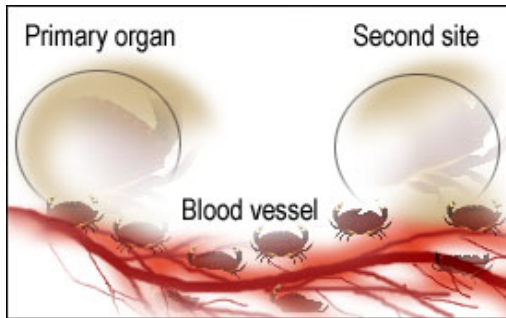
Cancer cells may infiltrate into nearby lymphatics, where they multiply and travel until they reach a lymph node. They invade and replace the lymph node, spreading into the surrounding tissue of the lymph node, known as 'extracapsular spread'.

### ***Vascular spread (blood system)***

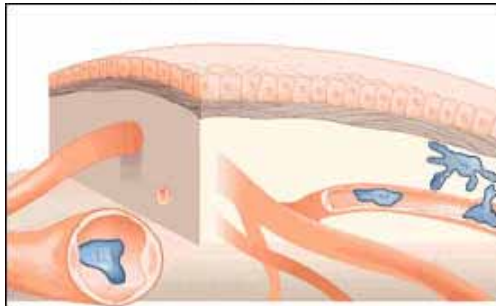
Invasion of blood vessels within the primary tumour allows tumour cells to be transported through the blood stream to another part of the body, where they lodge and may develop a secondary tumour.

Common sites of distant spread are liver, lung, brain and bones, as these organs

receive a rich blood flow from all parts of the body.



**Blood-borne metastases**



**Distant Metastases**

*Pictures courtesy of SEER*

## Histological types of malignancy

From a histological viewpoint there are hundreds of different cancers, which are grouped into five major categories (plus some cancers of mixed types). These are:

- Carcinoma
- Sarcoma
- Myeloma
- Leukaemia
- Lymphoma

### Carcinoma

Carcinomas are malignant neoplasms of epithelial origin and are divided into two major subtypes:

- **Adenocarcinoma** – which develops in an organ or gland, and
- **Squamous cell carcinoma** – which originates in the squamous epithelium.

### Epithelial tissue



*Picture courtesy of SEER*

### Sarcoma

Sarcomas are malignancies that arise in connective tissues such as bones, tendons, cartilage, muscle or fat. Examples of sarcomas are:

- Osteosarcoma or osteogenic sarcoma (bone)
- Chondrosarcoma (cartilage)
- Leiomyosarcoma (smooth muscle)
- Rhabdomyosarcoma (skeletal muscle)
- Mesothelial sarcoma or mesothelioma (membranous lining of body cavities)
- Fibrosarcoma (fibrous tissue)
- Angiosarcoma or hemangioendothelioma (blood vessels)
- Liposarcoma (adipose tissue)
- Glioma or astrocytoma (neurogenic connective tissue found in the brain)
- Myxosarcoma (primitive embryonic connective tissue)
- Mesenchymous or mixed mesodermal tumor (mixed connective tissue types)

### Connective tissue



*Picture courtesy of SEER*

### Myeloma

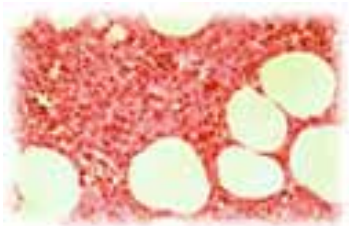
Myeloma is malignancy that originates in the plasma cells of bone marrow. The plasma cells produce some of the proteins found in blood.

## Leukaemia

Leukaemias are malignancies of the blood often associated with the overproduction of immature white blood cells. Examples of leukaemia include:

- Myeloid leukaemia
- Lymphocytic, or lymphoblastic leukaemia

### Leukaemic cells



Picture courtesy of SEER

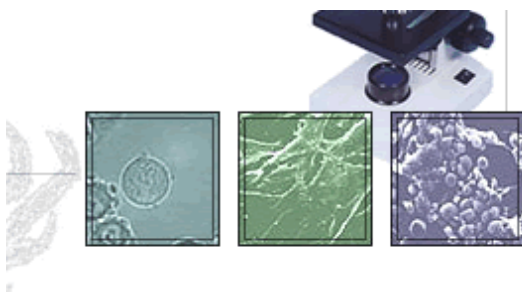
## Lymphoma

Lymphomas develop in the lymphatic system but may also occur in specific organs such as the stomach, breast or brain. These lymphomas are referred to as extranodal lymphomas. Lymphomas are subclassified into two categories: Hodgkin lymphoma and Non-Hodgkin lymphoma (NHL).

### Mixed tumours

Some examples are:

- Adenosquamous carcinoma
- Mixed mesodermal tumor
- Carcinosarcoma
- Teratocarcinoma



Pictures courtesy of SEER

# Cancer classification

## Tumour grade

Tumour grade is a system used to classify cancer cells in terms of how abnormal they look under a microscope and how quickly the tumour is likely to grow and spread. Many factors are considered when determining tumour grade, including the structure and growth pattern of the cells. The specific factors used to determine tumour grade vary with each type of cancer.

**Histologic grade**, also called **differentiation**, refers to how much the tumour cells resemble normal cells of the same tissue type.

**Nuclear grade** refers to the size and shape of the nucleus in tumour cells and the percentage of tumour cells that are dividing.

Depending on the biological appearance, cancers will be given one of three grades:

- **low grade** – when cancer cells look very much like the cells of origin, with slightly abnormal changes.
- **intermediate grade** – when cancer cells are becoming more abnormal, but still look like the cells of origin.
- **high grade** – when cancer cells look very abnormal and show little or no resemblance to the cells of origin.

The grade of the cancer indicates how aggressive the tumour is with:

- low grade indicating the cells are usually slow growing and less likely to spread
- high grade indicating the cells are growing quickly and are more likely to spread.

Well differentiated	grade 1	low grade
Moderately differentiated	grade 2	average / intermediate grade
Poorly differentiated	grade 3	high grade
Undifferentiated	grade 4	

## Stage

Staging is the grouping of cases into broad categories based on anatomical spread of the disease in a coded format. This enables analysis of cancers with similar characteristics.

The practice of dividing cancer cases into groups according to stage type arose when it was noted that survival rates were higher for cases in which the disease was localised than those for which the disease was widespread, often described as 'early' and 'late' stage.

### Why stage cancer?

- to aid the clinician to evaluate the most appropriate form of treatment by assessing the extent of cancer in order to give an indication of prognosis for an individual patient.
- provides a means of comparing local treatment results with national data based on common criteria for the extent of disease.
- to contribute in the continuing research on cancer.

### The TNM system

The staging classification used in the UK, and widely used throughout the world, is the TNM staging system. The concept of stage is applicable to almost all cancers except for most forms of leukaemia. Since leukaemias involve all of the blood, they are therefore systemic. However it must be remembered that TNM staging is usually applicable to 'carcinomas' arising in epithelial tissue and not sarcomas – with the exception of soft tissue and bone sarcomas. The system is a coded method of describing the extent of a particular tumour from **clinical** information or **pathological** verification.

Staging must be completed pre-operatively (clinical) and pathologically.

- **Clinical staging** is where all the information is ascertained prior to any definitive treatment, based on information from clinical examinations such as palpation, imaging, biopsy and other relevant non-surgical examinations such as endoscopy.

- **Pathological staging** is where all the information is ascertained from microscopic examination of the main surgical specimen, reported by the histopathologist and based on the excised specimen received. Lymph nodes are also usually excised to assess whether tumour cells have reached the lymphatic system, even if clinically they are negative.

TNM is based on the assessment of the following components:

- **T** = the extent of the primary tumour – size, depth of invasion within the organ or other adjacent organ
- **N** = the presence or absence of regional lymph node metastases, number involved, size or capsular invasion
- **M** = the presence or absence of distant metastases including lymph nodes that are not regional

*Each site of malignancy has different criteria for assessing TNM and the TNM6 classification book must be referred to in order to derive site-specific data stage.*

**T – Primary tumour**

TX	Primary tumour cannot be assessed histologically
T0	No histological evidence of primary tumour
Tis	<i>In situ</i>
T1	increasing size/extent of the primary tumour histologically
T2	
T3	
T4	

**N – Regional lymph nodes**

NX	Regional lymph nodes cannot be assessed histologically
N0	No +ve regional lymph nodes histologically
N1	increasing involvement of regional lymph nodes
N2	
N3	

**M = Distant metastases**

MX	Distant metastases cannot be assessed histologically
M0	No distant metastases histologically
M1	Distant metastases histologically

**Other methods of staging specific sites**

- **Dukes** staging (based on histological findings) refers to colorectal tumours: Dukes A is equivalent to Stage I, Dukes B is equivalent to Stage II, Dukes C is equivalent to Stage III, Dukes D is equivalent to Stage IV
- **FIGO** (Federation Internationale de Gynecologie et d'Obstetrique) refers to tumours of female reproductive system and is categorised from FIGO 0–IV comparable to Stage 0–IV.
- **Clark's** is a classification method for melanoma (and other skin cancers) based on depth of invasion of tumour categorised from Level I–V comparable to Stage 0–IV.
- **Breslow** is also a method of staging melanoma (and other skin cancers) but relates to thickness in millimetres of the tumour.

These classifications may sometimes be found in case notes or pathology reports.

**NPI (Nottingham Prognostic Indicator)** is a classification for breast cancer widely used by surgeons in the UK, in addition to TNM staging, as a prognostic indicator.

# Diagnosis

There are several tests available for diagnosing cancer depending on the symptoms and site of the body involved.

- **Clinical:** Normally, the patient will have a physical examination where any obvious lesions or palpable lumps may be identified and further tests may be required to confirm any suspicions. These tests may include blood tests, X-rays, MRI scans, CT scans, ultrasound scans, cystoscopy and endoscopy.
- **CT scan:** Computerised Tomography is a special kind of X-ray machine. Instead of sending out a single X-ray through the body as with ordinary X-rays, several beams are sent simultaneously from different angles. The computer processes the results, displaying them as a two-dimensional picture shown on a monitor.
- **MRI scan:** Magnetic Resonance Imaging. This is a fairly new technique that has been used since the beginning of the 1980s. It uses magnetic and radio waves, meaning that there is no exposure to X-rays or any other damaging forms of radiation. With an MRI scan it is possible to take pictures from almost every angle, whereas a CT scan only shows pictures horizontally. The difference between normal and abnormal tissue is often clearer on the MRI scan than on the CT scan. However, as they are very expensive, not every patient is sent for an MRI as usually ultrasound or CT will suffice.

- **PET scan:** Positron Emission Tomography. This is a fairly new type of scan developed in the 1970s but has only been in use in NHS hospitals in the last few years. PET scanners are also very expensive (about £700 per scan) and only a few hospitals in the UK have one, although this situation is improving all the time. A PET scan produces three-dimensional, colour images of the body using radiation. A PET scan works by detecting radiation inside the body, and makes images that show how the radiation is being broken down. Radiation is given to the body as a medicine called a radiotracer, so it goes to the part of the body that needs to be examined. The level of radiation is very small, so there is no risk of damage to the body.

## Confirming diagnosis

It is essential to get a sample of cells or tissue to confirm the morphology (cell type), as the treatment can be dependent on the cell type.

The following procedures can be used to establish the cell type, with the aim being a diagnosis prior to a full excision of the tumour site.

**Cytology** – fluid samples containing cells from within the tumour:

- fine needle aspirate (FNA), for tumours near to the body's surface, for example breast tumours
- bronchial brushings/washings, sample from within the lung
- urine, for urinary system tumours
- cervical smear, for tumours of the cervix
- ascites, fluid from the abdominal cavity
- pleural effusion – fluid from between the pleura and the lung

**Histology** – tissue samples excised from the tumour:

- biopsy – from the main tumour mass
- resection – of the main tumour mass



# Treatment of cancer

Once cancer has been diagnosed, the patient will be discussed at a multi-disciplinary team meeting (MDT meeting). A number of options are available and, when making treatment decisions, the multi-disciplinary team often discuss the patient's care from a number of different angles.

The treatment will depend on the specific type of cancer, plus the grade and stage of the tumour.

The most common forms of treatment are:

- Surgery
- Hormone therapy
- Drug therapy (Chemotherapy, Immunotherapy, Gene therapy)
- Radiotherapy

**Neo-adjuvant treatment** is treatment prior to surgery in order to downstage the tumour.

**Adjuvant treatment** is other treatment after surgery in order to lower the risk of tumour recurrence.

The treatment plan will be either radical (curative) or palliative.

- **Radical (curative):** the intent is to cure the patient of their cancer by whatever means are available.
- **Palliative:** the intent is to relieve symptoms generally when a cure is not a realistic option and support the patient as their condition declines.

The majority of patients who are treated curatively are treated with a combination of surgery, chemotherapy and radiotherapy. There are, however, other treatment options which can be used if appropriate.

## Surgery

*The excision or removal of a lesion which may include part, or all, of the affected organ, or ablation of the lesion for non invasive tumours or superficial tumours.*

Surgery is the most common first line treatment for all solid tumours. However, under certain circumstances, surgery may not be appropriate: for example, a large Basal Cell Carcinoma on the face, breast tumour in an elderly patient, or late stage tumours presenting with metastases for which radiotherapy may be a better option.

## Radiotherapy

*Treatment of disease with high energy radiation rays which damage cancer cells and stop them from growing and dividing.*

Radiotherapy is used in the following circumstances:

- to downstage or shrink a cancer prior to surgery (neo-adjuvant).
- to cure cancer when surgery isn't possible, or post-surgery to reduce the risk of recurrence.
- jointly with chemotherapy after surgery (adjuvant).

Radiotherapy can be delivered externally or internally, depending mainly upon which cancer site is being treated.

### Externally

- **Teletherapy** – using X-rays or other radiation in a concentrated beam aimed at the area being treated. A planned course of radiotherapy is usually given over a number of days or weeks. Each treatment is known as a 'fraction' and is measured in Grays (Gy's).

### Internally

- **Brachytherapy** – using radioactive materials placed inside an organ, between tissue (interstitial), or close to the area being treated. Sites commonly suitable for radioactive implants are uterus, vagina, rectum, cervix, prostate, mouth and neck. The implants vary in time in the body from a few minutes to a few days and some types are never removed e.g. seeds inserted into a prostate cancer.

## Chemotherapy

Chemotherapy literally means ‘chemical therapy’, and involves the use of chemicals, or cytotoxic drugs, to destroy cells (normal and abnormal); this is referred to as **systemic treatment**.

Chemotherapy drugs damage cancer cells more than they damage normal cells because cells are only vulnerable to chemotherapy when they are replicating.

Different cytotoxic drugs target different phases of the replication process – one of the reasons why most chemotherapy patients are given a combination of cytotoxic drugs to allow the cancer cells to be attacked more than once in order to destroy them.

Combinations or ‘regimes’ have been developed over time and there are certain regimes which are now advised to treat specific types of cancer.

## Hormone therapy

Hormone therapy is the manipulation of hormones for the treatment of some cancers known to be hormone sensitive or hormone dependent. The cancers within this group are those occurring in the breast, endometrium (uterus) and prostate. To a much lesser extent hormone manipulation can also be used in the treatment of kidney cancer. Biological tests will be carried out to check if the tumour is hormone dependent prior to the prescription of these hormones.

## Immunotherapy

Many cancers have developed ways of evading the immune system which normally destroys abnormal cells. Immunotherapy is the use of the immune system to fight cancer and boost the immune system.

**Monoclonal antibodies** are the production of large amounts of antibodies in a laboratory for the treatment of a particular cancer type.

## Targeted therapy

Targeted therapies are very different from more traditional types of anti-cancer therapies, as they target specific characteristics of cancer cells such as a changed protein or the formation of new blood vessels. Targeted therapies do not harm normal, healthy cells and tend to have few side effects.

Most targeted therapies are antibodies that work like the antibodies made by the immune system, so are also called Immunotherapy

- *Herceptin* (chemical name: trastuzumab) is the best known targeted therapy for breast cancer which only works against breast cancers that have extra HER2 genes and make too many HER2 protein receptors.
- *Tykerb* (chemical name: lapatinib) is another targeted therapy that works against breast cancers that have extra HER2 genes.
- *Avastin* (chemical name: bevacizumab) targets the new blood vessels that feed cancer cells.

## Gene therapy

Gene therapy works by putting genetic material (DNA) into cells so that the cells produce proteins which they do not usually produce. These proteins will help to fight disease.

Gene therapies are at an early stage of development and are currently in trials for assessment.

# Tumour type guide

These terms are commonly used when dealing with cancer patients:

Carcinoma	Cancer that arises in the epithelium (skin and membranes of the internal organs and some other tissues containing epithelial cells).
Neoplasm	New or abnormal growth that is uncontrolled and progressive.
Tumour	Abnormal growth of tissue.

The following terms are descriptions of the more commonly found neoplasms and also some of the more rare. It is not an exhaustive list but could be described as the basis on which to start learning about the different types of neoplasms.

Acanthoma	Tumour originating from the prickle cell layer of the epidermis. Usually applied to benign tumours.
Acute lymphoblastic leukaemia (ALL)	Cancer of immature lymphocytes, called lymphoblasts, common in children.
Acute myeloblastic leukaemia (AML)	Cancer of immature myeloblastic cells, a type of white blood cell. Affects adults of all ages, although more common in the older age range – rare in the under 20s.
Adenocarcinoma	Malignant epithelial tumour arising in glandular tissue, or other tissue showing a glandular growth pattern. Cancers of the colon, breast, pancreas and kidney are usually adenocarcinomas.
Adenofibroma	A benign tumour of connective tissue which contains glandular structures.
Adenoma	Tumour of glandular tissue, usually of benign or uncertain behaviour.
Adenosarcoma	Malignant tumour of connective and glandular tissue.
Angioma	An innocent tumour composed of dilated blood vessels (not registrable at cancer registries).
Angiosarcoma	Also known as haemangiosarcoma, a malignant tumour formed by proliferation of endothelial and fibroblastic tissue – code to connective tissue site code.
Astroblastoma	Malignant blood vessel tumour of the brain.
Astrocytoma	Malignant brain tumour arising in the glial cells of the central nervous system. Most commonly develops in the cerebrum of adults and the cerebellum of children.
Basal cell carcinoma	Skin cancer that is also known as a 'rodent ulcer'. The most common form of skin cancer and rarely metastasises.
Bowen's disease	Intraepidermal ( <i>in situ</i> ) disease of skin.
Carcinomatosis	The malignant dissemination of cancer throughout the body.
Carcinoid tumour	Malignant or uncertain behaviour. They originate from the argentaffin cells in the glands of the intestine. Usually found in the digestive tract or the bronchial tree.
Cholesteoma	A small tumour containing cholesterol which may occur in the middle ear. Also occurs in the meninges, central nervous system and bones of the skull.

Cholangiocarcinoma	Malignant growth in one of the bile ducts that carries bile from the liver and gallbladder to the small intestine. The main symptoms are jaundice and weight loss.
Choriocarcinoma	Malignant neoplasm usually arising from the trophoblast of a hydatidiform mole. Metastases usually develop rapidly, but prognosis is usually good, following early treatment.
Chondrosarcoma	Cancer of the cartilage that can develop within a bone or on its surface occurring commonly within large bones such as the femur, tibia and humerus. It is slow growing and surgery is the only treatment option – not sensitive to radiotherapy or chemotherapy. Code to cartilage site with the following exceptions: <ul style="list-style-type: none"> <li>• juxtacordical chondrosarcoma</li> <li>• mesenchymal chondrosarcoma</li> </ul>
Dysgerminoma	Malignant tumour of the ovary, thought to arise in the primitive germ cells. Average age at diagnosis is 20.
Dysplasia	Abnormality of cells such as size, shape and rate of multiplication.
Encephaloma	Benign tumour of the brain.
Endothelioma	Malignant growth originating from the endothelium (lining of the heart, blood vessels and lymphatic vessels).
Ependymoma	Neoplasm arising from the lining cells of the brain ventricles and central canal of the spinal cord. It can obstruct the flow of cerebrospinal fluid causing hydrocephalus.
Epithelioma	Cancer originating from the epithelium (external skin and internal membranes with the exception of the blood and lymphatic vessels).
Embryonal	Arising in embryonal precursors e.g. embryonal rhabdosarcoma, embryonal yolk sac tumours.
Ewings sarcoma (tumour)	Named after J Ewing (1866 – 1943) an American pathologist. Affects the long bones in children and young adults, commonly spreading to the lung. Sensitive to radiotherapy and chemotherapy.
Fibroma	Usually benign but can be uncertain behaviour.
Fibroepithelial tumour	Tumour composed of fibrous and epithelial elements, can be malignant or uncertain behaviour.
Fibrosarcoma	Cancer arising in fibrous tissue of the bone or connective tissue. Code to connective tissue with the following exceptions: <ul style="list-style-type: none"> <li>• ameloblastic fibrosarcoma</li> <li>• odontogenic fibrosarcoma</li> <li>• These should be coded to bone.</li> </ul>
Glioblastoma multiforme	Malignant tumour of the brain derived from non-nervous (glial) tissue. Its rapid enlargement destroys brain cells with progressive loss of function, raised intracranial pressure – causing headaches, vomiting and drowsiness. Treatment is never curative and the prognosis is poor.
Glioma	Any malignant tumour of the non-nervous (glial) cells in the CNS. Includes glioblastoma and astrocytomas but excludes subependymal glioma (uncertain behaviour).
Granular cell carcinoma	Malignant tumour of soft tissue, particularly skin, muscle and tongue.
Haemangioblastoma	Tumour of the brain or spinal cord arising in the blood vessels of the brain meninges. Can be malignant or uncertain behaviour.
Haemangioma	Malignant or benign behaviour. Site is connective tissue.

Haemangiosarcoma	Malignant tumour of the connective tissue.
Hepatoblastoma	Malignant liver tumour occurring in infants and small children. It is often confined to one lobe of the liver and treated by excision of that lobe.
Hepatoma (hepatocellular carcinoma)	Malignant tumour arising in the mature liver cells. Rare in western countries in normal livers, often arising in patients with cirrhosis or hepatitis B/C infections. In tropical zones it is common and thought to be associated with fungi and other ingested toxins.
Histiocytoma	Tumour of the macrophages or histiocytes and can be malignant, uncertain behaviour or benign – atypical histiocytoma, uncertain behaviour of the connective tissue – malignant histiocytoma, malignant tumour of the connective tissue – histiocytoma unspecified, benign.
Hodgkin's disease (Hodgkin's lymphoma)	Malignant disease of lymphatic tissue – a form of lymphoma characterised by painless enlargement of lymph nodes. The spleen, liver, bone marrow and bones can also be involved. It is characterised by the presence of Reed-Sternberg cells.
Hydatidiform mole	Rare condition of the placenta, usually non-malignant.
Hypernephroma (renal cell carcinoma)	Malignant tumour of the kidney cells. It is not sensitive to radiotherapy or chemotherapy, therefore surgery is the best treatment option. Some do respond to hormone therapy and immunotherapy. Accounts for seventy five per cent of kidney cancers.
Immunoproliferative disease	Proliferation of lymphoid cells.
Intraepithelial neoplasm	Pre-invasive or <i>in situ</i> .
Kaposi's sarcoma	Malignant tumour arising in the blood vessels of the skin, appearing as purplish to dark brown plaques or nodules. Common in Africa but rare in the western world, although common in AIDS patients. Commonly treated with radiotherapy and chemotherapy.
Krukenbergs tumour	Named after GPH Krukenberg (1871 – 1946), a German gynaecologist. Malignant tumour of the ovaries, that is secondary to a primary growth in the stomach or intestine
Leiomyoma	Can be uncertain behaviour or benign – cellular leiomyoma and epithelioid leiomyoma, uncertain behaviour of the connective tissue – all other leiomyomas are benign.
Leiomyosarcoma	Malignant tumour of smooth muscle commonly found in the uterus, stomach, small bowel and base of bladder.
Lentigo maligna (Hutchinsons melanotic freckle)	Non-invasive form of melanoma that has not deeply invaded to become a melanoma.
Leukaemia	Malignant disease in which the bone marrow and other blood-forming organs produce increased numbers of certain white blood cells. Overproduction of immature or abnormal white blood cells, suppresses the production of normal white cells, red cells and platelets.
Linitis plastica (leather bottle disease)	Malignant condition of the stomach where the stomach submucosa becomes rigid and narrows.
Lipoma	Benign tumour composed of fatty tissue.
Liposarcoma	Rare malignant disease of the fatty tissue. Most commonly found in the fatty tissue of the thigh and rare under the age of thirty.

Lymphoma	<p>Malignant tumour of the lymph nodes in which the lymphoid cells multiply unchecked. Lymphoma's fall into two main categories:</p> <ul style="list-style-type: none"> <li>▪ Hodgkin's lymphoma</li> <li>▪ non-Hodgkin's lymphoma</li> </ul>
Medulloblastoma	<p>Malignant brain tumour usually of the cerebellum occurring particularly in children. It tends to obstruct the circulation of the cerebrospinal fluid and cause intracranial pressure and hydrocephalus. The tumour grows rapidly and may spread to other parts of the CNS.</p>
Melanoma	<p>Malignant tumour of the melanin pigmented cells of the skin, choroids and mucous membranes. The most serious form of skin cancer it is usually found in an existing mole that changes shape, bleeds, spreads or forms a blackened edge.</p>
Meningioma	<p>Malignant, uncertain behaviour or benign tumour of the meninges (the fibrous covering of the brain and spinal cord). It is treated by removal if possible and radiotherapy.</p>
Mesonephroma	<p>Rare malignant tumour of the female genital tract.</p>
Mesothelioma	<p>Malignant tumour predominantly arising in the pleura, but also the peritoneum and pericardium. Linked to asbestos exposure. There is no curative treatment available, but radiotherapy and chemotherapy can achieve moderate to good results.</p>
Mucoepidermoid carcinoma	<p>Malignant tumour showing characteristics of both mucous secreting and epidermal cell types.</p>
Multiple myeloma (myelomatosis)	<p>Malignant condition of the bone marrow caused by uncontrolled proliferation and disordered function of the plasma cells. Usually seen in patients from middle to old age.</p>
Mycosis fungoides	<p>T-cell lymphoma that arises in the upper dermis of the skin. It produces a red, scaly rash that does not itch and may remain unaltered for many years. In the severe form of the disease, thickened patches of skin and ulcers may develop and lymph nodes may become enlarged.</p>
Myosarcoma	<p>Malignant tumour of the muscle.</p>
Myxosarcoma	<p>Sarcoma containing mucoid material.</p>
Nephroblastoma (Wilms tumour)	<p>Malignant tumour of the kidneys that rapidly spreads to lungs, liver and brain. Accounting for ten per cent of cancers in children under the age of five. Also known as embryonal adenomyosarcoma, carcinosarcoma and nephroma. It can be associated with a mutation of a gene on chromosome thirteen.</p>
Neuroblastoma	<p>Malignant tumour of the adrenal gland or sympathetic nervous system. The most common solid tumours of childhood to be found outside the skull. About eighty per cent occur within the first ten years of life, more commonly the first four years. Responds very well to chemotherapy.</p>
Neuroepithelioma	<p>Malignant tumour of the retina of the eye. A form of glioma that can spread into the brain if not treated early enough.</p>
Oat cell carcinoma	<p>Malignant tumour, usually of the lungs, very aggressive and consisting of small ovoid cells. It is usually associated with cigarette smoking and accounts for around twenty five per cent of bronchial cancers.</p>
Odontogenic	<p>Arising in tissue which gives origin to the teeth.</p>
Oligodendroglioma	<p>Rare, slow growing tumour of the central nervous system. Usually affects young or middle aged adults.</p>

Osteochondroma	Tumour of the bone composed of cartilage forming cells, usually found at the end of long bones. Common between ten and twenty five years of age. A small percentage of these tumours become malignant, therefore excision is recommended.
Osteosarcoma	Malignant tumour of the bones that spreads rapidly to the lungs and other sites.
Pancoast's tumour	Named after HK Pancoast (1875–1939) an American radiologist. Pain, wasting and weakness of the arm occurring as a secondary feature to carcinoma of the bronchus found in the apex of the lung, due to neurological involvement.
Paraganglioma	Tumour that can be malignant, uncertain behaviour or benign.
Plasmacytoma	Malignant condition of plasma cells, known as solitary myeloma. Usually occurring as a single tumour, if multiple tumours occur it is classified as multiple myeloma.
Polycythaemia rubra vera	Rare, uncertain behaviour, disorder of the bone marrow. It is characterized by an absolute increase in red cell mass resulting in an increased volume and thickening of the blood, causing headaches, blurred vision and hypertension. An enlarged spleen is also common.
Renal cell carcinoma	See hypernephroma.
Reticulosarcoma	A form of non-Hodgkin's lymphoma that is usually undifferentiated or histiocytic.
Retinoblastoma	Malignant tumour arising from the retinal germ cells. Genetically based as all the cells of patients with this cancer carry a mutation on chromosome number 13.
Rhabdomyosarcoma	Malignant tumour of the striated muscle that is often found in children. It grows rapidly and metastasises early.
Sarcoma	Malignant tumour of the connective tissue, they are much less common than carcinoma's but are often highly aggressive.
Seminoma	Malignant tumour of the testis.
Small cell carcinoma (oat cell carcinoma)	An anaplastic carcinoma composed of small cells. It is the most aggressive a rapidly spreading form of lung cancer.
Squamous cell carcinoma	Malignant tumour arising in skin and membranes of internal organs. It is the second most common form of skin cancer, occurring generally in middle to old age.
Teratoma	Malignant, uncertain or benign behaviour. Usually found in the ovary or testis.
Thymoma	Malignant or benign behaviour. These are rare tumours of the thymus and can affect the function of the immune system, causing increased susceptibility to infection.
Transitional cell carcinoma	Malignant, <i>in situ</i> or uncertain behaviour. They present in the urothelium, the lining of the urinary collecting system of the urinary tract, predominantly the bladder. It is the most common form of bladder cancers.
Wilms tumour	See nephroblastoma.



# Medical terminology

Medical terminology is the universal language of medicine, which originates predominantly from the Latin and Greek languages. Words may be difficult to pronounce and may appear long and complicated. However, once the structure of the vocabulary is known, the words themselves become understandable.

To understand medical terminology it is important to understand the structure. Most medical terminology consists of two or three parts as follows:

## *Prefix–root–suffix*

Sometimes a connecting vowel is added to aid pronunciation in order to make the word flow freely, and then becomes as follows:

## *Prefix–root–connecting vowel–suffix*

For example,

**Prefix**    **root**    **connecting vowel**    **suffix**  
**ENDO**    **METR**    **I**    **OSIS**

Inside uterus disorder = Disorder of the lining of the uterus

or

## *Prefix–connecting vowel–root–suffix*

Therefore the key to understanding medical terminology is learning the meaning of root words, prefixes and suffixes.

The following tables contain a restricted list of root terms, prefixes and suffixes but there are many more which you must make yourself aware of:

## Root terms

Root	Meaning
aden	gland
ano	anus
arthr	joint
cardi	heart
cephal	head
cerebr	brain
cervic	neck
cholecyst	gall bladder
chol	bile
chondr	cartilage
col	colon
cost	rib
crani	skull
cyst	bladder, sac
derm	skin
encephal	brain
enter	intestine
gastr	stomach
hepat	liver
hyster	uterus
Ile, eile	ileum
lip	fat
mamm, mast	breast
Metr	uterus
myo	muscle
nephr	kidney
neur	nerve
oesophag	gullet
ooph	ovary
ophthalm	eye
optic	eye
orchi♣	testis
ost	bone
pneumo	lung
rhin	nose
spondyl	vertebra, spinal column
thorac	chest
ur	urine

## Prefixes

Prefix	Meaning
A, a	Without, not
Ab	away from
Ad	towards
Ante	before
Anti	against
Bi	two, both
brady	slow
con	together, with
contra	against, opposite
dys	bad, improper
Ec ecto	out of, outside
endo	within
epi	upon, after, in addition
hemi	half
hyper	over, excessive
hypo	beneath, below
infra	below, after
inter	between
intra	inside, within
par, para	beside, beyond
per	through
peri	around, surrounding
poly	many
pre, pro	before, in front of
retro	backwards
semi	half
sub	beneath
supra	above
tachy	fast
trans	across, through
Suffix	Meaning
aemia	blood
algia	pain
centesis	perforation, tapping
ectasis	dilation, expansion, distension
ectomy	excision
genic	producing, productive of
gram	letter, drawing
itis	inflammation
malacia	softening

megaly	enlargement
ology	study of
oma	tumour
osis	process, disease, condition
pathy	disease
penia	abnormal reduction
plasty	plastic repair
rrhag	bursting out
rrhoea	flowing
scopy	inspection, examination
spasm	involuntary contraction
thermy	heat (use of)
tomy	incision

## Suffixes

Suffix	Meaning
aemia	blood
algia	pain
centesis	perforation, tapping
ectasis	dilation, expansion, distension
ectomy	excision
genic	producing, productive of
gram	letter, drawing
itis	inflammation
malacia	softening
megaly	enlargement
ology	study of
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scopy	inspection, examination
spasm	involuntary contraction
thermy	heat (use of)
tomy	incision

## Abbreviations

In understanding medical information, however presented, it is important to have a basic understanding of medical terms and abbreviations, here are some of the more common ones:

Abbreviation	Definition
#	Fracture
Anterior	The front surface (any point of reference)
BCG	Bacillus Calmette-Guerin
BSO	Bilateral salpingo-oophorectomy
Bx	biopsy
C	with
Ca	cancer
Ca <sup>++</sup>	calcium
CBD	Common bile duct
CCF	Congestive cardiac failure
CHOP	Chemotherapy regime using a combination of drugs
CIS	Carcinoma in situ
CNS	Central nervous system
COAD	Chronic obstructive airways disease
COPD	Chronic obstructive pulmonary disease
CSF	Cerebro spinal fluid
CVA	Cerebro vascular accident (stroke)
CXR	Chest X-ray
Distal	Farthest from (away from the head)
DNA	Did not attend
Dorsal	Pertaining to the back or towards the back
DXR	Deep X-ray therapy
DXT	Deep X-ray treatment
Dx	Diagnosis
ECG	electrocardium
EEG	electroencephalogram
EUA	Examination under anaesthetic
FH	Family history

FNA	Fine needle aspirate
Hx	History of
Inferior	Situated below
ISQ	In status quo (no change)
Lateral	To the side
Medial	To the mid-line
NAD	Nothing abnormal diagnosed/detected
NEC	Not elsewhere classified
NFA	No further appointment
NIDDM	non insulin dependent diabetes (mellitus)
NOS	Not otherwise specified
OE	On examination
OGD	oesophagogastrroduodenos
Peripheral	Situated away from the centre
PMB	Post menopausal bleed
PMH	Previous medical history
Posterior	back
PR	Per rectum
Proximal	Nearest to the head
PSA	Prostatic specific antigen
Pt	patient
Retrograde	Going backwards or opposite way to normal
RIP	Rest in peace
Rx or Px	Prescription
SOB	Shortness of breath
SOL	Space occupying lesion
Superior	Situated above
TAH + BSO	Total abdominal hysterectomy and bilateral salpingo-oophorectomy
TIA	Transient ischaemic attack
TCI	To come in
TITA	Too ill to attend
TLC	Tender loving care
TPR	Temperature, pulse and respiration
TUR	Trans urethral resection
Tx	treatment
Ventral	Pertaining to the belly or towards the belly
XRT	X-ray treatment

+ve	Positive
-ve	Negative
1/7	One day
3/7	Three days
1/52	One week
1/12	One month

## Directional terms and anatomical position

To describe where certain organs or conditions are within the body, it is necessary to use precise terminology. The following is a list of commonly used directional terms

Medical term	Description
Afferent	conducting inwards, towards a part of organ (used descriptively for nerves, blood and lymph)
Anterior	front of the body
Caudal	tail, or tail-like appendage (do not confuse with cauda equina, which refers to the tail-like portion of the spinal cord)
Cephalic	pertaining to the head
Contralateral	on the opposite side of the body
Deep	central, away from the surface of the body
Distal	furthest from the head
Dorsal	refers to the back or the posterior part of an organ

	or body
Efferent	used to describe vessels (blood or lymph) or nerves carrying away from the central organ or section
Inferior	lower, beneath
Intermediate	between two structures
Ipsilateral	on the same side of the body
Lateral	away from the median line or the middle of the body
Medial	pertaining to near the middle
Median	the middle, an imaginary line passing through the body from between the eyes to between closed feet
Palmar	referring to the palm of the hand or the flexor surface of the hand
Peripheral	pertaining to the outer parts of an organ or the body
Posterior	to the back of the body
Prone	lying on front with face turned to one side
Proximal	nearest to the head
Superficial	toward or on the surface of the body
Superior	towards the head, or the upper of two parts
Supine	lying on back with face upwards
Ventral	referring to the abdomen or the anterior surface of the body

# Anatomy

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# The digestive system

## General anatomy

The main organs of the digestive system form a muscular tube extending from the lips to the anus. This tube is open at both ends and is also called the alimentary canal or gastrointestinal (GI) tract.

The organs that compose the GI tract are the mouth, pharynx, oesophagus, stomach, small intestine, colon and rectum, and anus. The mouth and pharynx are discussed separately in the head and neck anatomy section.

Other accessory organs and structures, derived from the primitive gut, are located in

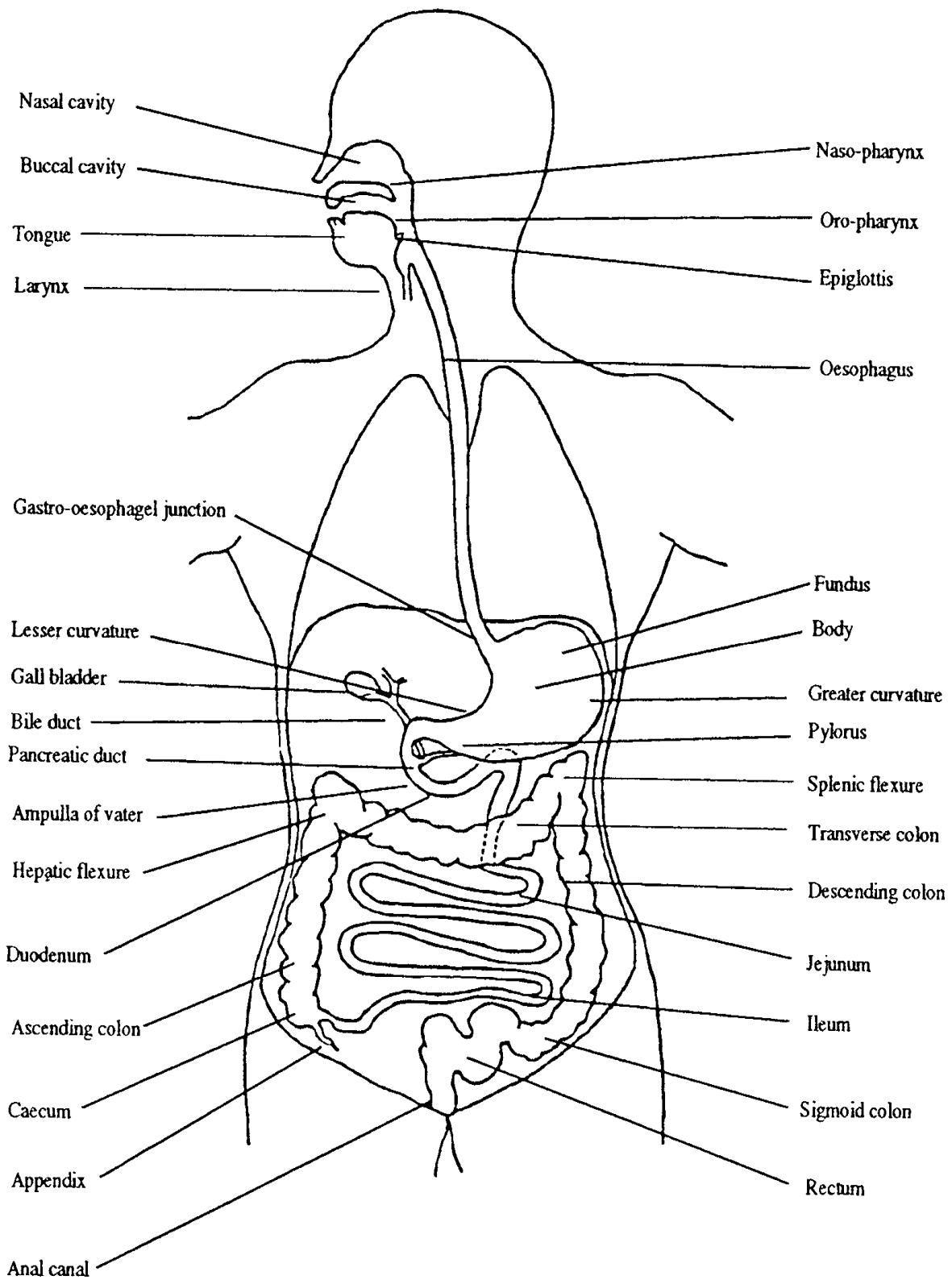
either the main digestive tract or opening into it. They include the pancreas, gallbladder, bile ducts, liver and appendix.

## General function

The digestive system breaks down food into nutrients so that it can be used by the cells in the body.

The mouth begins the preparation as it is chewed and then swallowed. A bolus is moved down the oesophagus into the stomach where gastric juices begin to change the nature of the food into a semi-liquid form. The digestion process and absorption of nutrients occur mainly in the small intestine through capillaries and lymph vessels in the intestinal lining. Undigested food moves by peristalsis to the large bowel where it is eventually evacuated via the rectum, anal canal and anus.

## The digestive system



## Oral cavity

### Anatomy

The lips form the anterior wall, the cheeks (buccal mucosa) form the lateral walls, the hard and soft palates form the roof, and the floor of the mouth forms the base. Other structures included in the mouth are the tongue (anterior 2/3), gums (gingiva) and teeth.

## Lips

### Anatomy

The lips consist of the exposed surface (vermillion border) and the inner labial mucosa. The commissure is the point of union of the upper and lower lips. The entire cavity is lined by mucous membrane.

### Common histologies

1. Squamous cell carcinoma
2. Verrucous carcinoma - occurs on buccal mucosa or alveolar ridges.
3. Spindle cell-type squamous cell carcinoma
4. Adenocarcinoma occurs in minor salivary glands.

## Tongue

### Anatomy

The tongue is a mobile mass of striated muscle covered by mucous membrane. The frenulum is the fold of the membrane on the undersurface of the tongue at the midline.

The tongue is divided into two portions, the anterior 2/3 and the base of the tongue. The anterior tongue is subdivided into the lateral borders and the tip, the dorsal (upper) surface and the ventral (under) surface.

Papillae are small nipple-shaped projections or elevations on which are located numerous taste buds.

The U-shaped hyoid bone is located between the root of the tongue and the larynx.

Muscles responsible for movement of the tongue are attached to it.

### Common histologies:

1. Squamous cell carcinoma.

## Salivary glands

### Anatomy

There are three pairs of major salivary glands:

1. The **parotid glands** are the largest and lie below and in front of the ears. They secrete saliva into the mouth by way of Stenson's duct. They are intimately involved with the facial nerve.
2. The **submandibular glands** lie in contact with the inner surface of the mandible. They secrete saliva into the mouth by way of Wharton's duct.
3. The **sublingual glands** lie beneath the mucosa of the floor of the mouth.

Minor salivary glands are scattered throughout the mucous membrane covering the lips, cheeks, palate and tongue.

### Common histologies

1. Pleomorphic adenoma, also called mixed tumour (usually benign).

The most common malignant tumour is mucoepidermoid carcinoma.

2. Malignant mixed tumour.
3. Squamous cell carcinoma.
4. Adenoid cystic carcinoma.
5. Adenocarcinoma found in minor salivary glands of upper gingiva and hard palate.
6. Acinic cell carcinoma.

## Pharynx

Food passes through the pharynx from the mouth to the oesophagus. The pharynx lies

behind the nose and larynx and is common to both the respiratory and digestive systems. Air passes through it from the nose to the larynx. The epiglottis (a small thin flap of cartilage) behind the tongue covers the larynx during swallowing to prevent food passing into the lungs.

### Anatomy

The pharynx is composed of muscle lined with a mucous membrane. Embedded in the muscle of the nasopharynx are the pharyngeal tonsils (the adenoids) which are composed of lymphoid tissue.

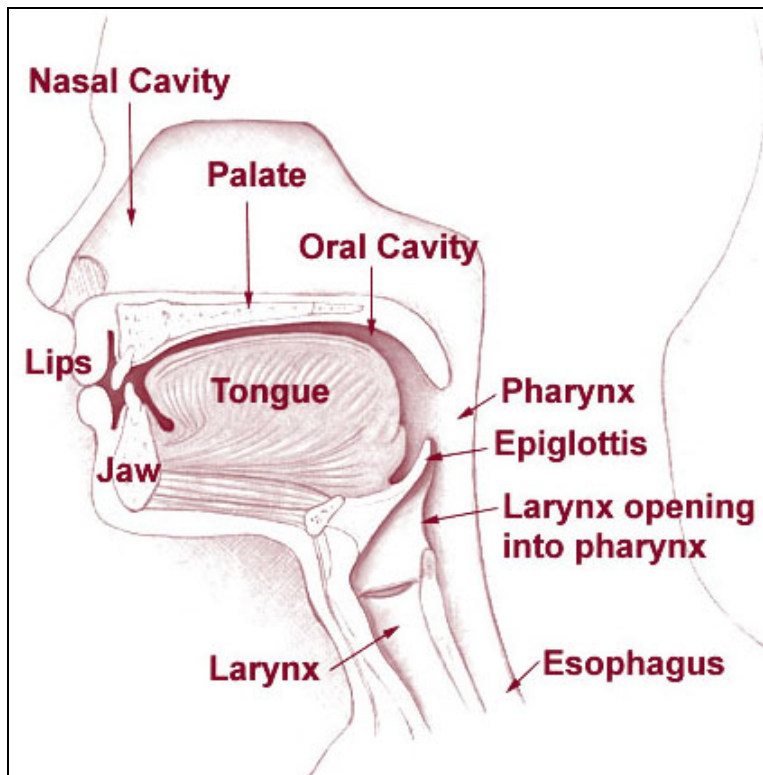
The faucial or palatine tonsils are located in the oropharynx. They are commonly removed by a tonsillectomy.

The lingual tonsils are in the base of the tongue.

The lymphoid tissues comprising the pharyngeal, palatine and lingual tonsils are sometimes referred to as **Waldeyer's ring**.

The pharynx is divided into three regions the nasopharynx, the oropharynx and the hypopharynx.

### Oral cavity



### Nasopharynx

The nasopharynx lies behind the nasal cavity, above the soft palate and below the base of the skull. The anatomy of this area is discussed with the respiratory system.

### Oropharynx

The oropharynx lies behind the buccal cavity, below the soft palate, and above the opening to the larynx. The oropharynx serves as a passageway for both food and air.

The oropharynx includes the anterior tonsillar pillar, soft palate, uvula, tonsillar fossa and tonsil, base of tongue and pharyngeal walls (lateral and posterior).

### Hypopharynx

The hypopharynx is located behind and lateral to the larynx. Another name for the hypopharynx is laryngopharynx. The hypopharynx serves as a passage for food only.

## Alimentary canal: Oesophagus

### Anatomy

The oesophagus extends from the hypopharynx to the stomach. It lies behind the trachea and heart in the posterior mediastinum and passes through the diaphragm at the hiatus between the thorax and abdomen.

The oesophagus is divided into three segments:- the cervical, thoracic and abdominal sections, also described as upper, middle and lower.

The three main tissue layers of the wall of the oesophagus are the mucosa, submucosa and muscularis propria.

The oesophagus has NO serosa but the tissue surrounding the oesophagus is known as the adventitia.

### Common histologies

1. Squamous cell carcinoma
2. Adenocarcinoma arises from columnar epithelium lining the distal oesophagus and from submucosal glandular elements. Frequently associated with reflux oesophagitis.

### Regional lymph nodes

Lower oesophagus	aortic lymph nodes
Mid oesophagus	mediastinal lymph nodes
Upper oesophagus	cervical or supraclavicular, lowest paratracheal, or azygous lymph nodes.

## Stomach

### Anatomy

The stomach lies just below the diaphragm and its main divisions are the cardia, the fundus, the body and the pyloric antrum.

It enlarges when food is received and gastric juices act on the food to break it down before it passes to the duodenum as chyme.

The pylorus is a powerful sphincter which regulates the passage of chyme into the duodenum at frequent intervals and prevents food from passing back into the stomach.

The greater omentum is a large fold of peritoneum which extends down from the anterior surface of the stomach and connects the abdominal viscera.

Rugae are ridges, wrinkles, or folds of mucous membrane which are found in the empty stomach. These folds greatly enlarge the surface area of the stomach.

The medial border is called the lesser curvature.

The lateral border is called the greater curvature.

### Common histologies

1. Adenocarcinoma
2. Linitis plastica is an advanced form of cancer that involves a large area of mucous membrane and presents with a foreshortened wall and a great deal of fibrous tissue.
3. Leiomyosarcoma arises in the smooth muscle of the stomach wall.
4. Lymphoma of the stomach, the most common extranodal site for lymphoma.
5. Squamous cell carcinoma occurs at the cardio-oesophageal junction and is actually an oesophageal tumour.

### Regional lymph nodes

Left (superior) gastric, inferior gastric, and splenic hilar.

## Small intestine

### Anatomy

The small intestine is about 7 metres (20 feet) long. The three divisions of the small intestine are the duodenum, jejunum and ileum (note spelling, not to be confused with the ilium, a bone of the pelvis).

Digestive juices and bile are emptied into the duodenum from the pancreas and gallbladder at the sphincter of Oddi.

The villi are small vascular processes or protrusions, covered by epithelium. They increase the surface area needed for absorption of nutrition into the bloodstream or lymph vessels.

### Common histologies

1. Adenocarcinoma
2. Lymphoma
3. Leiomyosarcoma
4. Carcinoid

## Colon and rectum

### Anatomy

The colon absorbs water and some chemicals but its main function is storage and evacuation.

It is about 1.5 metres (5 feet) long but larger in circumference than the small intestine. The large intestine is divided into three parts: the colon, the rectum and the anus.

The colon is divided into 5 segments – the caecum, ascending colon, transverse colon, descending colon and sigmoid colon. In addition, the colon has two flexures (bent portion of a structure or organ), one in the area of the liver (hepatic flexure) and one in the area of the spleen (splenic flexure).

The ileocecal valve in the caecum joining the ileum with the large bowel, prevents the contents of the colon from regurgitating into the small bowel.

The vermiform appendix is a diverticulum off the caecum (lower right quadrant of the abdomen).

There are no villi in the large intestine.

The longitudinal muscle layer is arranged in three flat bands called taenia coli.

The ascending and descending colon are attached to the posterior abdominal wall by folds of peritoneum called mesenteries.

The rectum lies below the peritoneal reflection (outside the peritoneal cavity) and has no serosa.

The Pouch of Douglas is a sac or recess formed by a fold of the peritoneum dipping down between the rectum and the bladder (male) or uterus (cul de sac).

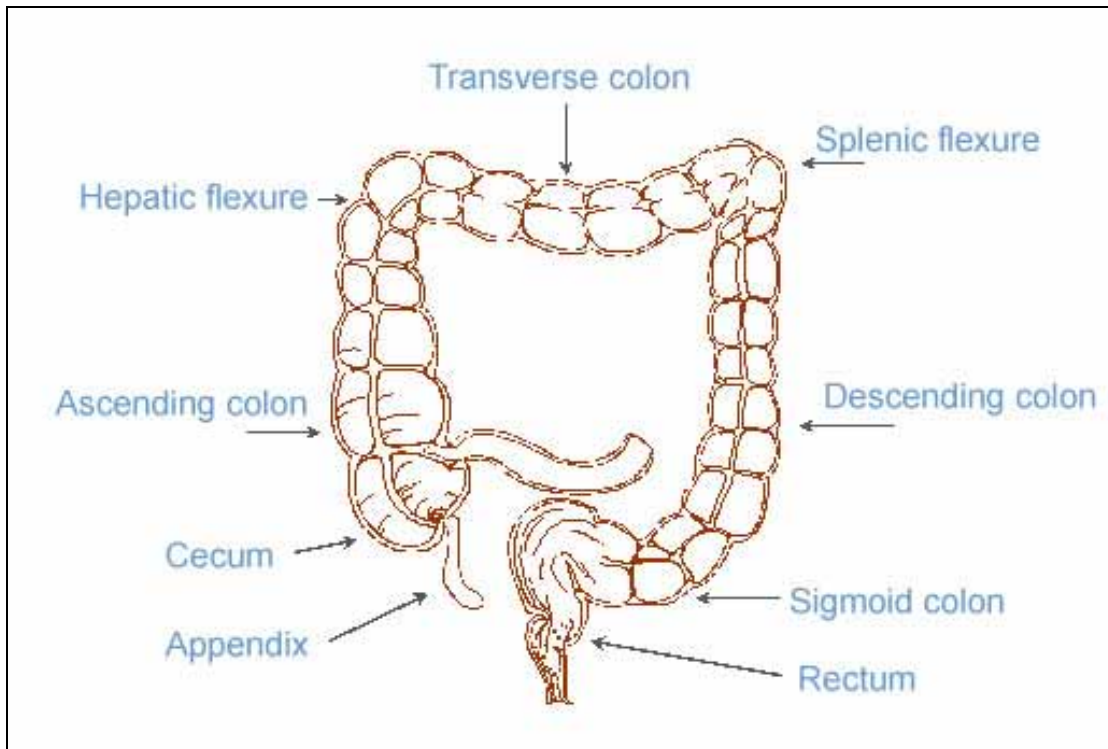
### Common histologies

1. Adenocarcinoma
2. Carcinoids of the appendix are the most common appendiceal tumours. They rarely metastasise.
3. Squamous cell carcinoma, the most common malignancy of the anus.
4. Cloacogenic transitional cell carcinomas arise at the anorectal junction.
5. Other malignancies include leiomyosarcoma and lymphomas.
6. Adenomatous polyps are benign however villous adenomas are potentially malignant tumours and are classified as 'borderline' or 'uncertain' tumours.

### Regional lymph nodes

Caecum:	anterior and posterior caecal, ileocolic, right colic.
Ascending colon:	right and middle colic, ileocolic
Transverse colon:	middle colic
Descending colon:	left colon inferior mesenteric, sigmoid
Sigmoid:	inferior sigmoid, mesentery, superior rectal and haemorrhoidal sigmoid
Rectum:	superior and inferior haemorrhoidal, sigmoid and inferior mesenteric.

## Colon and rectum



courtesy of SEER

## Liver

### Anatomy

The liver is the largest internal organ of the body and has many functions connected with digestion. It stores vitamins and iron and is the main heat-producing organ in the body.

Bile is produced in the liver where it passes through the intrahepatic ducts to the common hepatic duct and on to the gallbladder. The cystic duct of the gallbladder merges with the hepatic duct to form the common bile duct which empties into the duodenum at the Ampulla of Vater.

N.B. Liver malignancy is most frequently due to metastatic disease from another primary site.

### Common histologies:

1. Primary malignancies of the liver are rare. The most common primary malignancy of the liver is hepatocellular carcinoma (also known

as hepatoma or liver cell carcinoma). Hepatocellular carcinoma arises in the parenchymal cells of the liver and is associated with a pre-existing cirrhosis of the liver.

2. Cholangiocarcinoma (bile duct carcinoma) arises in the intrahepatic bile ducts and is also found in the extrahepatic bile ducts.

## Gallbladder

### Anatomy

The gallbladder lies against the under-surface of the right lobe of the liver and has dual blood supply:

1. Arterial blood from hepatic artery
2. Venous blood (from the intestines) via the portal vein.

The gallbladder stores bile from the liver ready to be expelled into the duodenum when required.

***Common histology:***

1. Adenocarcinoma.

## **Pancreas**

***Anatomy***

The pancreas is divided into the head (near the stomach), body and tail (near the spleen).

Pancreatic juices are secreted via the main duct (duct of Wirsung) into the duodenum via the Ampulla of Vater.

***Common histologies:***

1. Adenocarcinoma
2. Islet cell carcinoma arise in the Islets of Langerhans. These may be insulinomas, glucagonomas, or gastrinomas based on their hormonal activity.

# The respiratory system

Respiration is the process by which oxygen is taken in and transported to be used by tissues in the body and carbon dioxide is expelled into the air.

## General anatomy

The respiratory system consists of the nose, nasopharynx, larynx, trachea, bronchi and lungs. The nasopharynx is also described in the section on pharynx.

The mediastinum is the region in the chest cavity between the lungs which contains the heart, aorta, oesophagus, thymus, trachea, and lymph nodes.

## Nose and paranasal (accessory) sinuses

### Anatomy

The nose consists of two nasal cavities formed by the maxilla and the palatine bone and the nasal, frontal, ethmoid, and sphenoid bones.

The conchae (turbinates) are three bony structures on the lateral walls.

The nostrils are the external orifices.

The choana is the posterior orifice opening in to the nasopharynx.

The paranasal sinuses are air cavities lined with mucous membrane. The frontal sinuses are located in the frontal bone above the orbital cavities. The ethmoid sinuses are made up of small air cells located between the upper nasal cavities and the orbits. The sphenoid sinuses are wedge-shaped sinuses in the bone at the back of the orbital cavities. The maxillary sinuses (antrum of Highmore) are located in the maxilla.

### Common histologies:

1. Squamous cell carcinoma
2. Adenocarcinoma
3. Adenoid cystic carcinoma
4. Melanoma
5. Lymphoma

## Nasopharynx

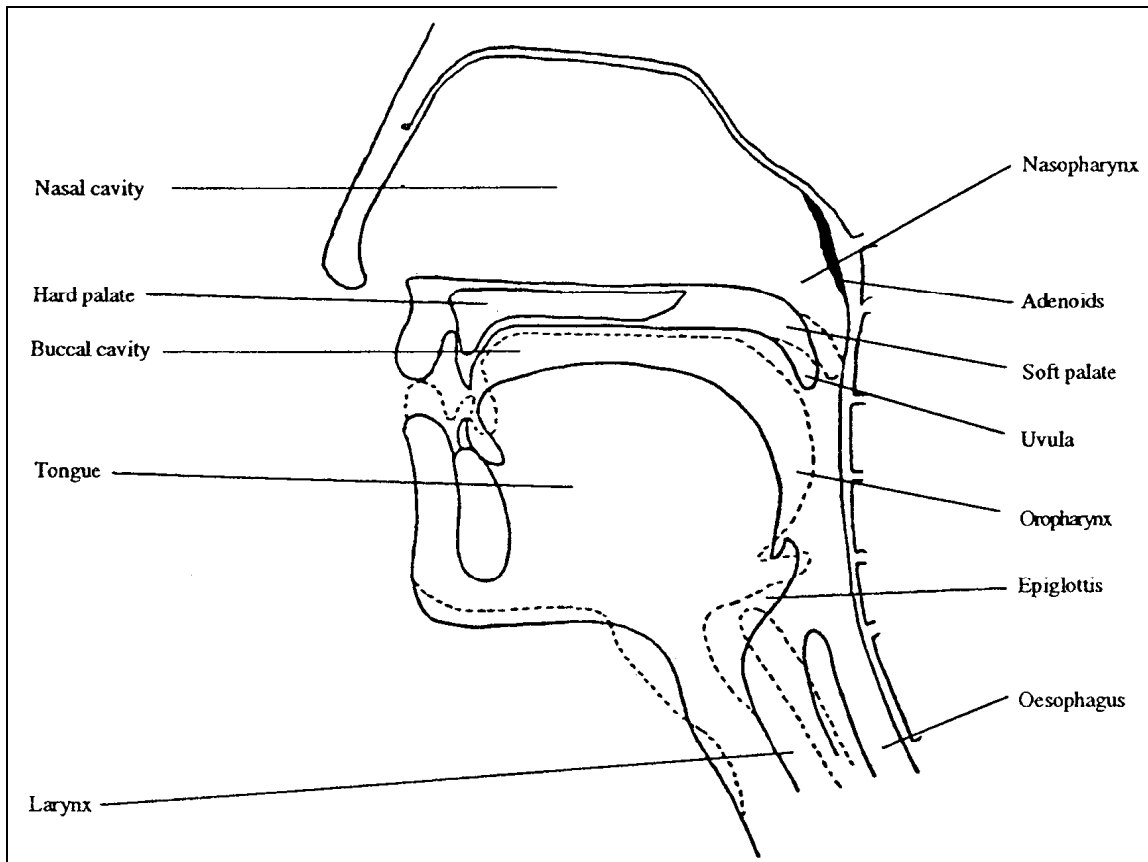
### Anatomy

Subsites of the nasopharynx are posterior superior wall (vault) and the lateral wall.

Common histologies:

1. Squamous cell carcinoma. Lesions tend to be poorly differentiated. Non-keratinizing carcinoma and lymphoepithelioma are variants of squamous cell carcinoma.

## Head and neck



## Larynx

### Anatomy

The larynx is a complex structure in front of the hypopharynx and contiguous with the upper end of the trachea. It is lined by squamous epithelium.

The three single and most important cartilages are:-

- Thyroid cartilage (Adam's apple)
- Epiglottis which has a hinge-like action forming a lid over the opening of the larynx when swallowing takes place
- Cricoid cartilage (signet-ring in shape) which forms the inferior border of the larynx

There are also three paired cartilages:-

- Arytenoid cartilages
- Corniculate cartilages
- Cuneiform cartilages

These are united by joints that are strengthened by membranes and ligaments.

The false cords are two horizontal folds in the mucous membrane lining the larynx. Below them are the true cords which are fibrous bands stretched across the hollow interior of the larynx.

The glottis is the space between the true vocal cords.

The larynx is subdivided into three anatomic subsites:- the supraglottis, the glottis, and the subglottis.

### Common histologies:

1. Squamous cell carcinoma.

## Trachea, bronchus and lung

### Anatomy

#### Trachea

The trachea is a semi-rigid tube measuring about 115 cm long and 12 mm diameter which is composed of smooth muscle lined with mucous membrane and C-shaped rings of cartilage embedded in the muscle.

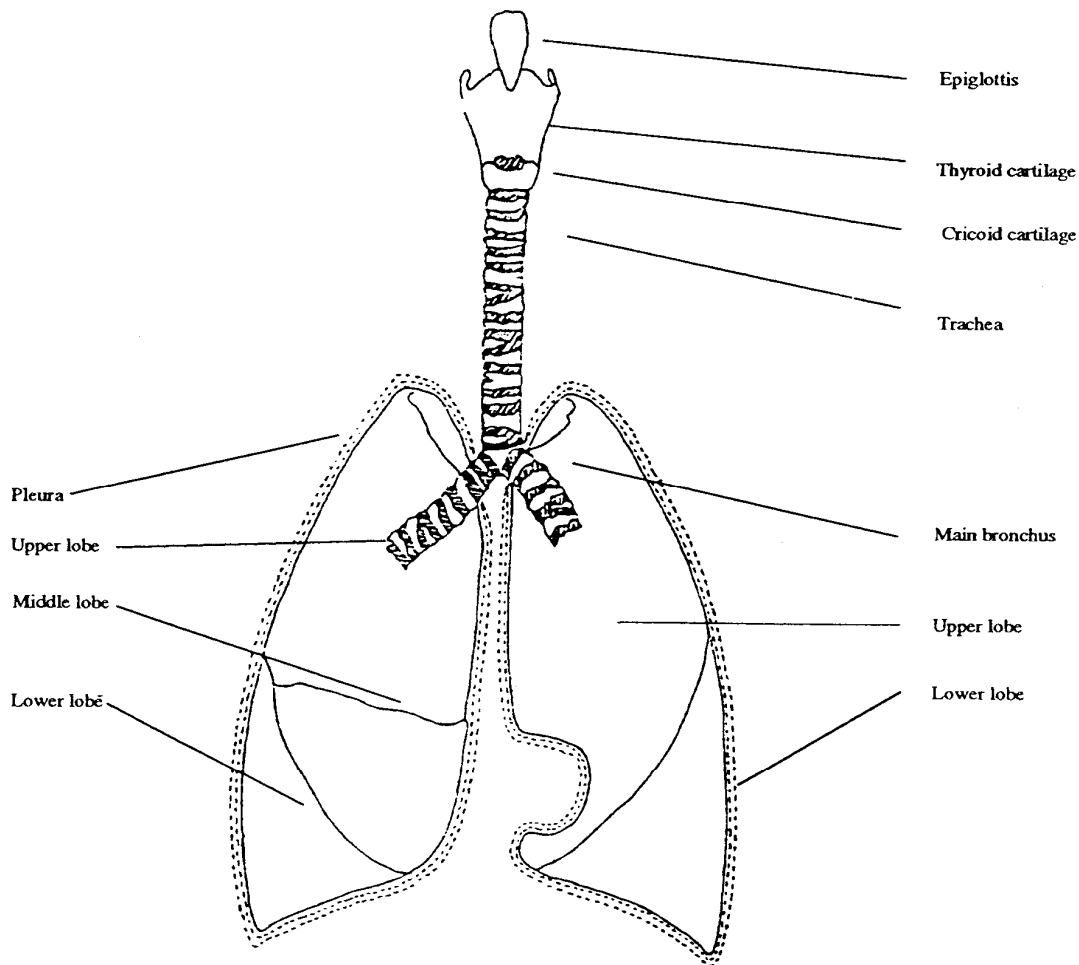
It extends from below the cricoid cartilage of the larynx to the carina. The larynx forms a major part of the passageway through which external air reaches the lungs.

#### Bronchus

The bronchi (plural form of bronchus) start at the lower end of the trachea with a bifurcation (the carina) into the right and left main bronchi. The wall of the bronchi are made of cartilage with a ciliated mucous lining.

The extrapulmonary portion of the bronchus enters the lung on each side and immediately divides into branches called lobar or secondary bronchi. The lobar bronchi divide further into smaller segmental bronchi.

## Respiratory system



### Lungs

The apex is the rounded upper portion of each lung. The base is the concave lower portion resting on the diaphragm. The hilus or hilum is the area on the medial surface through which the main bronchus, pulmonary artery and vein, nerves and lymph vessels enter and leave each lung.

The left lung is divided into two lobes (upper and lower). The right lung is divided into three lobes (upper, middle and lower). The lingula (coded to upper lobe lung) is an area projecting from the lower portion of the left lower lung.

When the main bronchus enters the lung, it branches into the lobar bronchi. The bronchi continue to subdivide, becoming segmental bronchi, bronchioles, and ultimately alveolar ducts. These terminate in the alveolar sacs. Alveolar sacs which are enveloped by capillary networks provide surfaces where the exchange of air and carbon dioxide takes place.

The lobar bronchi are lined with ciliated columnar, mucin-producing epithelium. Cilia are the hair-like structures attached to the mucous epithelium lining the respiratory tract.

The walls are composed of submucosa, smooth muscle, fibrous tissue and cartilage.

The visceral pleura covers the outer surfaces of the lungs and adheres to them. The parietal pleura lines the inside of the thoracic cavity.

The potential space between the visceral and parietal pleura is called the interpleural space or pleural cavity. The mesothelium is another name for the pleura.

Reserve cells are cells in the basal or germinal layer of the bronchial epithelium.

Scalene lymph nodes are found in the supraclavicular area along the scalenus muscles of the neck. Recurrent laryngeal nerve paralysis (causing hoarseness) is caused by pressure from mediastinal lymph node enlargement (metastasis).

The phrenic nerve runs through the root of the lung and innervates the diaphragm. Tumour involvement of the phrenic nerve causes paralysis of the diaphragm.

Pancoast tumour (superior sulcus tumour) occurs in the apex of the lung and frequently involves the brachial plexus causing neuritic pain in the arm.

Horner's syndrome is caused by paralysis of the cervical sympathetic nerves. It is manifested by ptosis of the upper eyelid and flushing of the affected side of the face – frequently associated with Pancoast tumour.

Superior venal caval syndrome (SVC) is produced by increased venous pressure due to compression of the superior vena cava, most commonly from metastatic mediastinal lymph nodes from lung cancer.

### ***Common histologies:***

1. Squamous cell carcinoma.
2. Adenocarcinoma.
3. Small cell carcinoma, also called oat cell carcinoma.
4. Large cell anaplastic carcinoma
5. Carcinoids of the lung also arise from neuroectoderm in embryology.
6. Bronchio-alveolar carcinoma a subtype of adenocarcinoma which rises in the terminal bronchioles or alveoli.
7. Mesothelioma arises in the pleura.

8. Melanomas may present as a primary lung lesion.
9. Lymphoma.

### ***Regional lymph nodes***

Interpulmonary, peribronchial, hilar, subcarinal, and mediastinal.

### ***Distant lymph nodes***

Scalene, supraclavicular, and cervical.



# The circulatory and cardiovascular systems

## The circulatory system

The function is to transport oxygenated blood, nutrients and chemicals to the tissues of the body and to carry waste products away from the cells for removal.

## The cardiovascular system

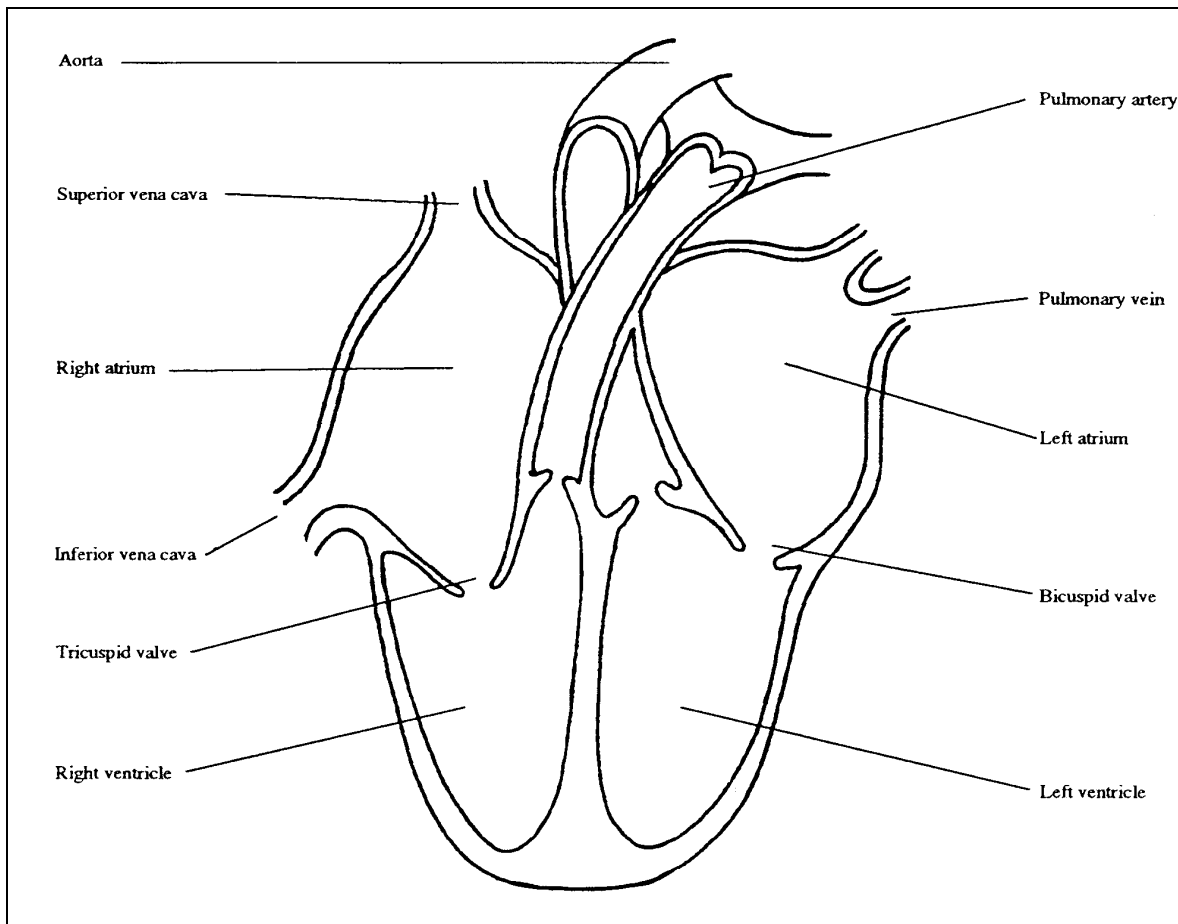
### *Anatomy*

The cardiovascular system consists of the heart, and blood vessels (arteries, veins and capillaries).

There are three systems within the circulatory system:

- The **pulmonary** system – blood from the heart passes to the lung where oxygen is absorbed and carbon dioxide is excreted then passes back to the heart.
- The **systemic** system – blood passes from the heart to all parts of the body where oxygen is taken up by body tissue and then blood returns via veins to the heart.
- The **portal** system – blood from the digestive system passes to the liver where the distribution of nutrients is controlled.

### The heart



## The lymphatic system

### Anatomy

The lymphatic system consists of three major components:-

1. **Lymphatic vessels** – a network of vessels of different sizes (the smallest lymphatic vessels are the lymph capillaries, which begin in the tissue spaces as blind-ended sacs).
2. **Lymph** – the fluid of the system - a clear fluid that comes from the blood and bathes the tissues. It contains water, protein and minerals and white blood cells. The lymph passes through a series of filters the lymph nodes before it rejoins the blood stream.
3. **Lymph nodes** – clusters of filtration tissue

Lymphoreticular cells are found in lymph nodes, spleen and bone marrow. Other extranodal lymph organs include the thymus, tonsils and Peyer's patches.

The lymphatic system has three primary functions:

1. The lymphatic system collects lymph from tissues of the body via the lymphatic capillaries, helping return excess fluid to the blood. Lymph capillaries pick up the excess interstitial fluid and proteins and return them to the venous blood. Lymph is filtered through the lymph nodes and finally empties into the subclavian veins of the blood circulatory system.

The main lymphatic trunks (terminal ducts) are the right lymphatic duct and the thoracic duct.

The thoracic duct is the larger of the two terminal ducts. It passes through the thoracic cavity and empties into the vena cava in the area of the left supraclavicular region. The thoracic duct receives lymph from all parts of the body below the diaphragm and from the left half of the body above the diaphragm.

2. Absorption of fats and fat-soluble vitamins from the digestive system and the subsequent transport of these substances to the venous circulation.
3. Defence against invading microorganisms and disease. Lymph nodes and other lymphatic organs filter the lymph to remove micro-organisms and other foreign particles. Lymphatic organs contain lymphocytes that destroy invading organisms.

### *The difference between veins and lymphatics*

Lymphatics have lymph nodes and do not carry red blood cells.

The sinus channels of lymph nodes are lined with reticuloendothelial cells (or histiocytes). Reticuloendothelial cells are special cells which ingest and destroy old erythrocytes and foreign substances. They are found mostly in lymph nodes, liver, spleen and bone marrow.

Lymph nodes give rise to lymphocytes and/or plasma cells. Lymphocytes develop from primitive parent or stem cells in the bone marrow and mature under the influence of bone marrow or the thymus.

T-lymphocytes mature in the thymus gland.

B-lymphocytes mature in the bone marrow (some in the intestine).

The primary function of lymphocytes is to defend the body against disease.

Lymphocytes respond to antigens in two ways:-

1. T-Cells originate from thymus gland and bone marrow. They secrete toxins and enzymes that digest the antigen.
2. B-Cells originate from bone marrow, spleen and lymph nodes. They are changed to plasma cells which produce antibodies.

The spleen filters blood. Through the process of phagocytosis, bacteria and worn out red blood cells and platelets are removed from the blood. The spleen also produces lymphocytes and plasma cells.

The thymus manufactures T-cells. It is a lymphatic organ and may also be an endocrine gland.

### Lymph node sites

Axillary	axilla (armpit)
Buccal	face, around the cheeks
Cervical	lateral portion of the neck (posterior and anterior).
Epitrochlear	behind and slightly above the elbow.
Femoral	upper medial thigh.
Hilar	chest (within the lung)
Iliac	around iliac blood vessels
Infraclavicular	below the clavicles
Inguinal	in the groin
Intercostal	between the ribs
Mediastinal	central chest cavity
Mesenteric	in the mesentery of small intestine and colon.
Occipital	posterior base of skull
Peribronchial	chest (within the lung)
Popliteal	behind knees
Sacral	in front of the sacrum
Submandibular	below the mandible
Submaxillary	below the mandible (same as submandibular)
Submental	under the chin (central)
Supraclavicular	above the clavicles

### Other terminology

**Sezary cells** are of T-lymphocyte origin (especially "helper" T-lymphocytes).

**Waldeyer's ring** is an area of lymphatics in the oral cavity which includes adenoids, tonsils and lymphoid tissue in the base of the tongue.

**Peyer's patches** are small aggregates of lymphoid tissue found in the lamina propria of the small intestine, principally in the distal ileum.

### Lymphomas

Lymphomas are malignant solid tumours of the lymphoreticular system that usually occur in lymph nodes.

Two major classifications of these tumours:

1. Non-Hodgkin's lymphomas
2. Hodgkin's disease

#### *Non-Hodgkin's Lymphomas (NHL)*

##### *Common histologies:*

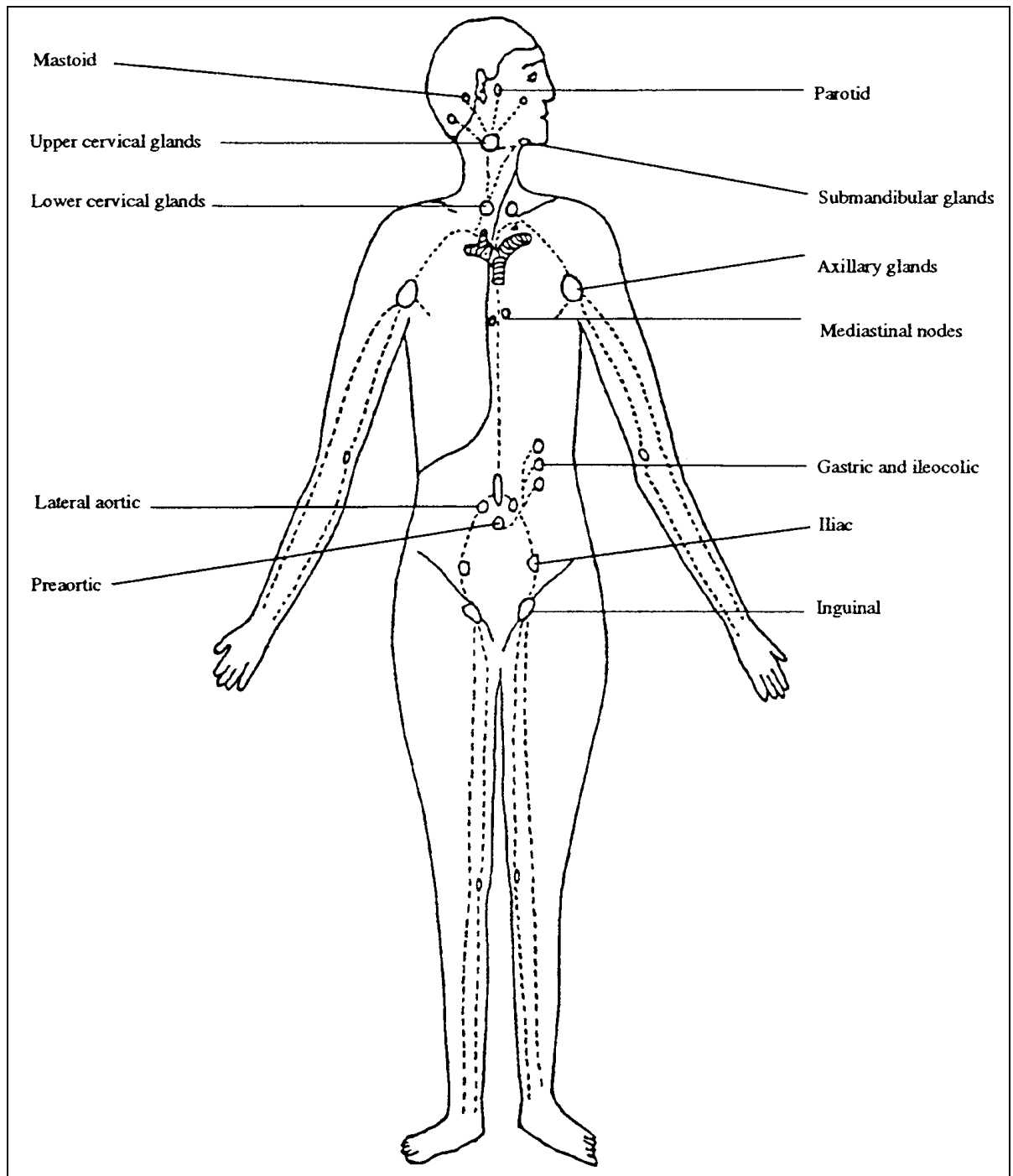
1. Nodular, Follicular or Diffuse
2. Centrocytic or Lymphocytic
3. Centroblastic or Histiocytic
4. Mixed centrocytic/lymphocytic and centroblastic/histiocytic
5. Undifferentiated.
6. Burkitt's Lymphoma.

#### *Hodgkin's Disease*

##### *Common histologies:*

1. Nodular sclerosis
2. Lymphocyte predominance
3. Mixed cellularity
4. Lymphocyte depletion

**Lymph nodes**



## The haematopoietic system: Multiple myeloma

Multiple myeloma is a neoplastic proliferation of plasma cells, characterized by lytic bone lesions and anaemia.

The three most common (highest concentration) immunoglobulins are IgG, IgA, and IgM. Immunoglobulins consist of light and heavy chains.

Monoclonal gammopathy occurs when one immunoglobulin is elevated and suggests the possibility of multiple myeloma or a lymphoproliferative syndrome.

## The haematopoietic system: Leukaemias

### Anatomy

Two types of haematopoietic tissue:

1. Myeloid
2. Lymphoid

Blood is a form of connective tissue. It has two parts:

1. Plasma (the liquid)
2. Formed elements (blood cells). The three main types of blood cells are:
  - a. Red (erythrocytes). Haemoglobin in the erythrocytes transports oxygen from the lungs to tissues of the body and returns carbon dioxide.
  - b. White (leucocytes). Five sub-types of white blood cells are:
    - Neutrophils
    - Eosinophils
    - Basophils
    - Lymphocytes
    - Monocytes
  - c. Platelets (thrombocytes). Platelets are involved in the clotting mechanism of blood.

Blood cells are manufactured in the bone marrow.

The leukaemias are neoplasms in which two major defects are unregulated proliferation and incomplete maturation of haemopoietic or lymphopoietic progenitors.

Leukaemias originate in bone marrow, though leukaemic cells may infiltrate other organs.

Blast cells (stem cells) are an immature stage of cellular development.

### Common histologies

Leukaemias are classified as acute, subacute or chronic.

1. Acute lymphocytic leukaemia (ALL)
2. Chronic lymphocytic leukaemia (CLL)  
Subtypes of CLL are:
  - a. B-Cell CLL bears a close relationship with well-differentiated lymphocytic lymphoma.
  - b. T-Cell CLL frequently presents with cutaneous lesions, splenomegaly and hepatomegaly.
  - c. Null cell

Chronic lymphocytic leukaemia may be a disease progression of well-differentiated lymphocytic lymphoma.

3. Acute myelogenous leukaemia (AML)
4. Chronic myelogenous leukaemia (CML)

### Other hematopoietic histologies

1. Polycythemia Vera is a neoplastic process involving the abnormal proliferation of erythrocytes.
2. Di Guglielmo's Disease (erythro-leukaemia).
3. Hairy cell leukaemia.

# The musculoskeletal system

## General anatomy

The musculoskeletal system is composed of muscles, fascia, ligaments, bones and cartilage. Bones and cartilage form joints which are held together by ligaments. Joints are classified as immovable (synarthrosis), slightly movable (amphiarthrosis) and freely movable (diarthrosis).

## Cartilage

Cartilage is nonvascular connective tissue. Cartilage cells (chondrocytes) are nourished by means of blood vessels in the outer layer of perichondrium which covers the surface of the cartilage.

## Bone

### Function

1. Provides a supportive framework for the body.
2. Protects the vital organs.
3. Provides a leverage system with the muscles.
4. Functions as a storehouse for minerals, and supplies calcium and phosphorus to the blood.
5. Contains the bone marrow which produces red and white blood cells (haemopoiesis).

### Anatomy

Bone is derived from three cell lines:- osteogenic, chondrogenic and collagenic (containing fibrous connective tissue).

Bone is a vascular tissue permeated with tiny canals (canaliculi) that connect the lacunae (in which bone cells live) with each other and

serve as a transport system (haversian system) between the blood in the capillaries and bone cells (osteocytes).

Bones are classified into five types:

1. **Long** bones in the arms and legs.
2. **Short** bones are short and cuboid or irregular in shape with all three dimensions about the same (wrist, ankle).
3. **Flat** bones are the protection for soft body parts (ribs, sternum, pelvis and skull).
4. **Irregular** bones (skull, vertebrae, ear bones).
5. **Round** bones are small, flat round sesamoid bones, whose function is to eliminate or reduce friction. The patella is the largest sesamoid bone in the body.

Long bones are made of several parts.

- The diaphysis is the main shaft and is composed of dense bone. It provides support.
- The metaphysis is the mid shaft.
- The innermost portion is composed of cancellous bone.

The medullary cavity has trabecular, cancellous spongy bone marrow. The epiphyses are bulbous in shape allowing ample space for muscle attachments near joints. The epiphysis has a separate centre for bone growth. The periosteum is a fibrous membrane covering on the outside of the bone. Blood vessels, lymphatic vessels and nerves in the periosteum enter the haversian canals of compact bones.

There are two types of bone marrow in adults: yellow and red.

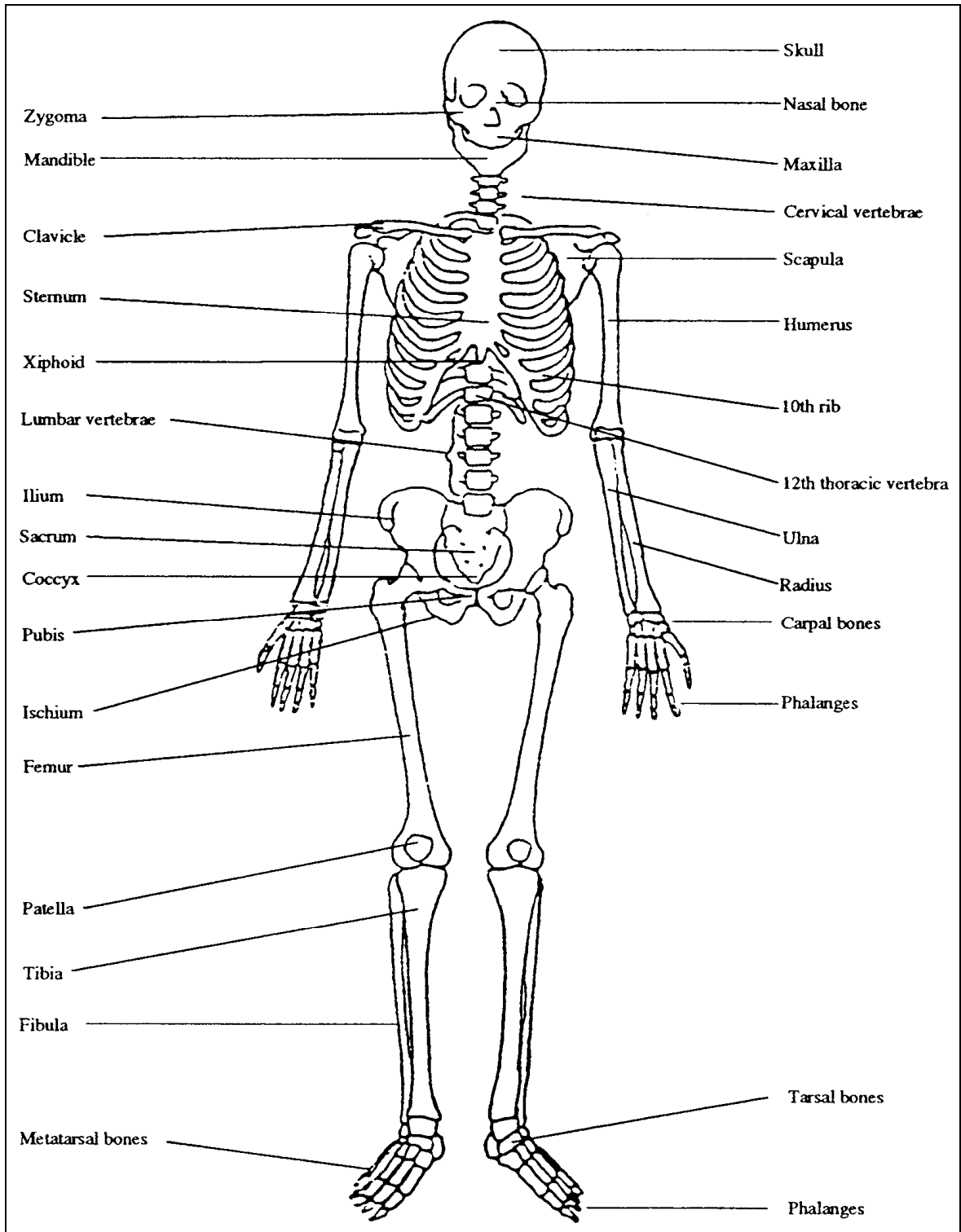
There are 206 bones in the adult body: The 80 bones of the upright axis form the axial skeleton which is the framework for the body. The axial skeleton includes the skull (29 bones,) the thorax (25 bones), and the vertebral column (26 bones).

The other 126 bones form the appendicular skeleton (extremities).

### ***Common histologies***

1. The most common malignancy of bone is metastatic tumour from other primaries. Site that frequently metastasize to bone are: breast, prostate, lung, colon, stomach and bladder.
2. The most common primary malignancy is osteosarcoma.
3. Tumours of cartilaginous or bony origin:
  - Osteogenic sarcoma
  - Chondrosarcoma
  - Ewing's Sarcoma
  - Giant Cell (malignant osteoclastoma)

**The skeleton**



## The muscular system

### Anatomy

Three types of muscles:

1. Skeletal (striated) are controlled by the peripheral portion of the central nervous system and are responsible for voluntary skeletal movement. The basic unit is a muscle fibre with many nuclei which are located in the periphery.
2. Smooth muscle is found in the walls of the hollow internal organs (blood vessels, GI tract, bladder). These muscles are controlled by the autonomic nervous system and are therefore involuntary. The muscle cell has only one nucleus.
3. Cardiac muscle, found in the walls of the heart, is also controlled by the autonomic nervous system. It is striated like skeletal muscle, but only has one nucleus like smooth muscle.

Each skeletal muscle merges into a tendon which attaches it to a bone.

Fascia is a fibrous sheet of connective tissue which separates muscles. Fascia are associated with all muscles including viscera, blood vessels and nerves.

### Common histologies

1. Malignant tumours of muscle are sarcomas.
2. Fibrosarcoma tumour of fibrous tissue.
3. Leiomyosarcoma, tumour of smooth muscle.
4. Rhabdomyosarcoma, tumour of striated muscle.
5. Angiosarcoma, tumour composed of blood vessels and muscular tissue.
6. Liposarcoma, tumour of fatty tissue.
7. Malignant fibrous histiocytomas arise from histiocytes and may arise in soft tissue of any part of the body.
8. Synovial sarcoma tumour arising in the tendon sheaths, bursa and joints.

# The skin

## General anatomy

The two primary layers of the skin are the epidermis and the underlying thick layer, the dermis or corium. The dermis has two layers: the papillary layer and the reticular layer.

Subcutaneous tissue is the connective tissue found under the dermis.

The tissue type of the epidermis is epithelium.

The tissue type of the dermis is connective tissue.

Both are derived from ectoderm.

Modified epidermal tissues include: fingernails, hair and glands of the skin.

Melanin causes the pigmentation of the skin and is produced by melanocytes. Melanocytes are located primarily in the basal layer of the epidermis and are derived from neural crest cells.

Melanoma is a skin malignancy derived from melanocytes or naevus cell.

A naevus is a mole or birthmark.

Accessory organs are found mainly in the reticular dermis.

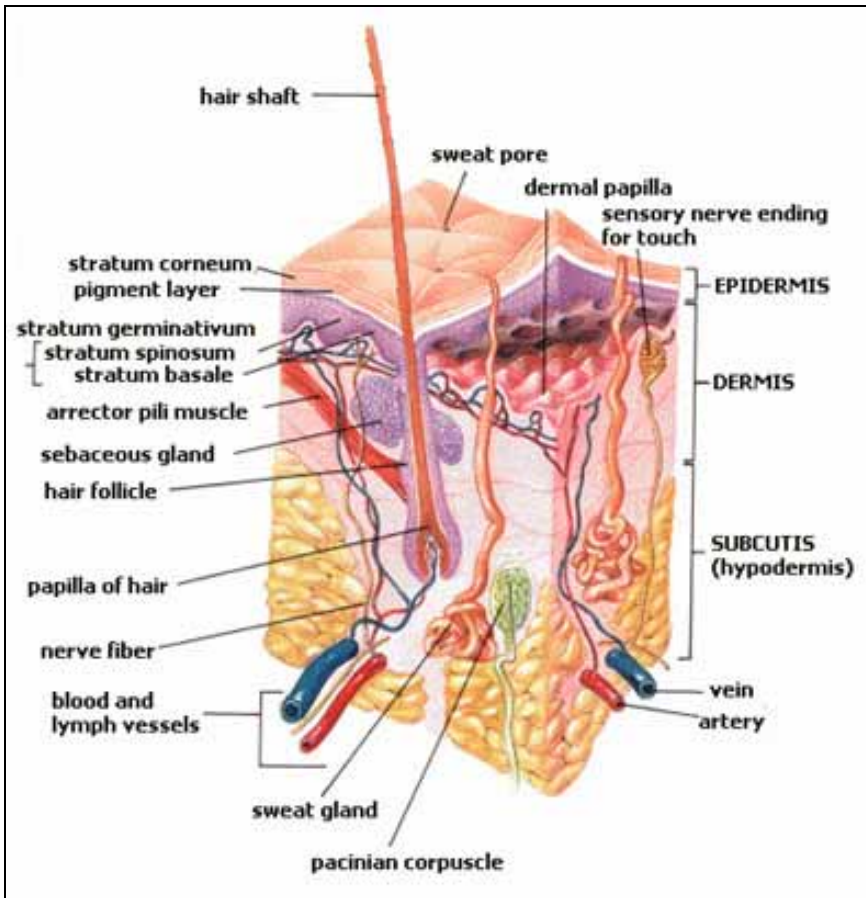
Three types of glands, or accessory organs are found in the skin:

1. Sebaceous means secreting an oily substance, sebum. Sebaceous glands are situated in the dermis.
2. Sudoriferous means secreting sweat. Sudoriferous glands are situated in the dermis and subcutaneous tissue.
3. Ceruminous means secreting a wax like substance, cerumen. Ceruminous glands are located in the skin of the external auditory canal.

## Common histologies

1. Basal cell carcinoma, the most common skin malignancy. It is locally invasive and almost never metastasises.
2. Squamous cell carcinoma, the second most common malignancy of the skin. It will metastasise to lymph nodes and viscera.
3. Bowen's Disease, intraepidermal squamous cell carcinoma.
4. Malignant Melanoma  
*Melanocytic origin:*
  - a) Lentigo maligna confined to the basal layer for a long time (in situ) before it enters the vertical growth phase. Also known as Hutchinson's freckle.
  - b) Acral lentiginous occurs mostly on the palms of the hands and the soles of the feet.  
*Naevocytic origin*
  - c) Radial (superficial) spreading is characterized by a radial growth phase for a long time before onset of the vertical growth phase.
  - d) Nodular melanoma, no radial growth phase.
5. Dermatofibrosarcoma – malignant tumour of the fibrous tissue of the dermis.
6. Mycosis Fungoides – malignant lymphoma of the skin characterized by erythema, scaling tumour formation and ulceration.

**Skin structure**



# The breast

## Anatomy

The breasts overlie the pectoral muscles.

The pectoralis major muscle lies beneath the breast.

The pectoralis minor muscle lies between the pectoralis major and the chest wall.

Each breast consists of multiple glandular lobes (15 to 20) which are further subdivided into lobules formed from minute ducts surrounded by alveoli. Lactiferous ducts connect the alveoli (secreting cells) to the nipple.

The areola is the darker, circular area bordering each nipple.

## Common histologies

1. Adenocarcinoma (ductal) arises from the glandular epithelium lining the ducts.

Infiltrating      lobular, medullary, mucinous, tubular.

Non-infiltrating      ductal carcinoma in situ, a precursor of invasive disease (also called intraductal carcinoma), includes comedocarcinoma; lobular carcinoma in situ.

2. Inflammatory carcinoma - a clinical diagnosis. Characterised by rapid development of a large tumour of the breast associated with reddening and oedema of the overlying skin, caused by spread of carcinoma through the lymphatics of the dermis.
3. Paget's Disease of the breast is a crusting lesion of the nipple and areola. Usually associated with an underlying breast cancer, either intraductal or infiltrating, with ductal

spread of tumour cells to the nipple area.

4. Adenocarcinoma is usually a tumour of ductal epithelial origin.
5. Cystosarcoma phyllodes.

## Regional lymph nodes

One of the first and most frequent areas of metastasis is the axillary nodes.

The low axillary lymph nodes are in the area next to the tail of the breast.

The mid axillary lymph nodes are under the pectoralis minor muscles.

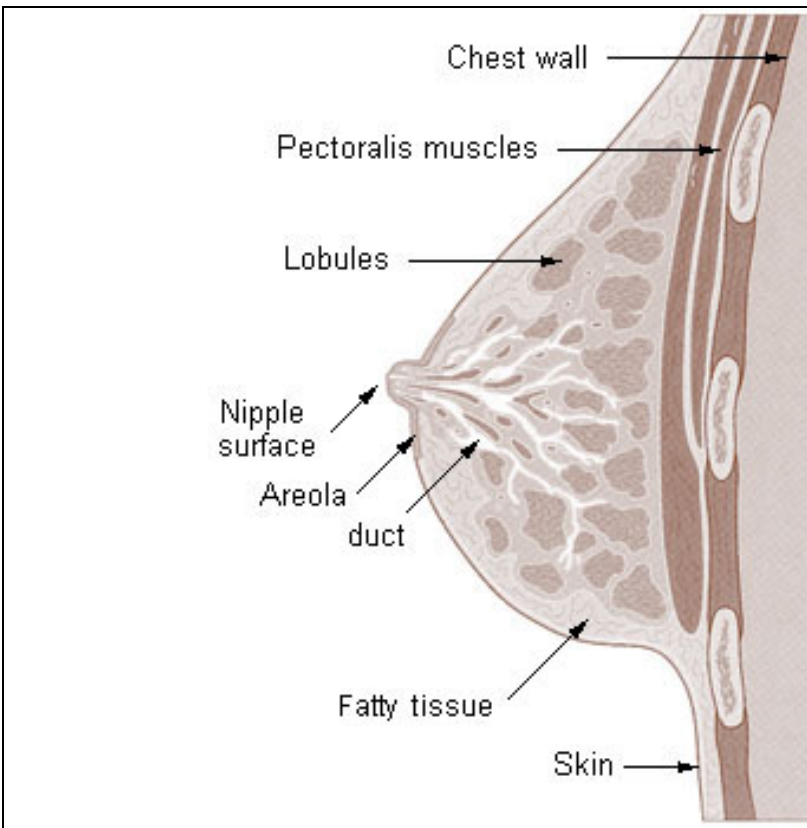
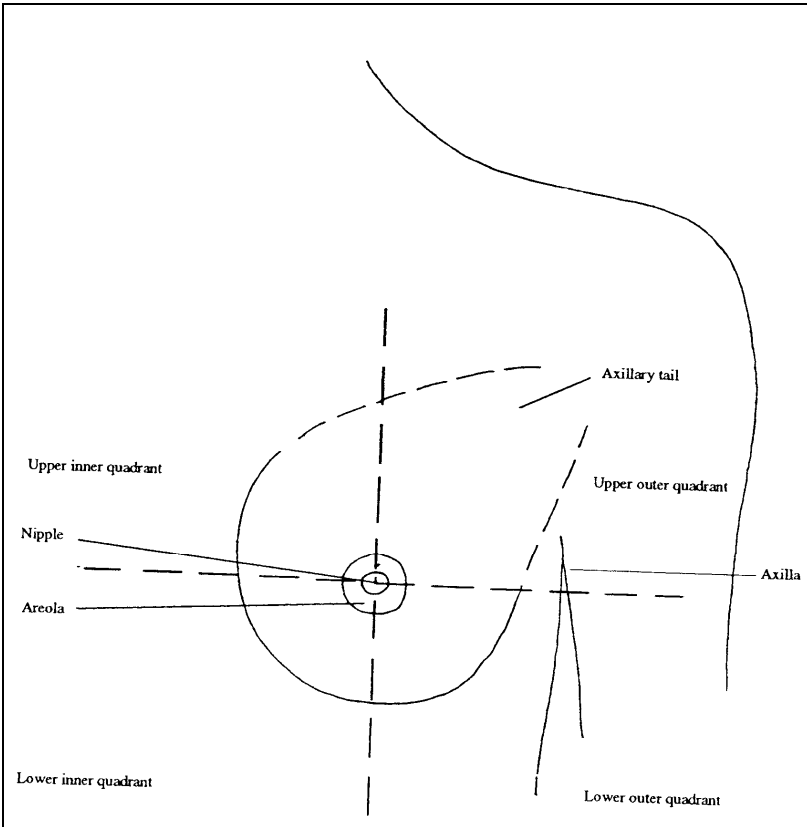
The high axillary lymph nodes are in the apex of the axilla.

The internal mammary lymph nodes are regional lymph nodes along the sternum.

## Distant lymph nodes

Supraclavicular, cervical, contralateral axillary mammary, axillary mammary and internal mammary.

**Left breast**



# The female reproductive system

## General anatomy

The female reproductive system consists of two ovaries, two fallopian tubes, the uterus including the cervix, the vagina and the vulva.

The breasts are considered to be accessory organs of the female reproductive system.

## Cervix

### Anatomy

The cervix, or neck of the womb, is covered with a stratified squamous epithelium that is continuous with the vaginal mucosa. This outer area is called the Exocervix. Higher up the cervical canal the cells become adenomatous and is known as the Endocervix. Four fornices from the vaginal wall form an arch-like vault around the cervix.

### Common histologies

1. Carcinoma *in situ*.
2. Squamous cell carcinoma (arises in exocervix).
3. Keratinizing squamous cell carcinoma.
4. Adenocarcinoma (arises in the endocervical canal).

### Most common site of tumour

Squamocolumnar junction.

### Regional lymph nodes:

1. Internal and external iliac.
2. Sacral chain.

## Uterus

### Anatomy

The uterus is a pear-shaped muscular organ in which the embryo develops after fertilization. It is located in the true pelvis between the bladder and the rectum. It is composed of two parts:

1. Body or corpus (upper portion): The rounded prominence in the body of the uterus above the level at which the fallopian tubes enter is called the fundus.
2. Cervix (lower, narrow portion).

The three layers of the uterus are:-

**Endometrium**, (mucosa) the epithelial inner lining and mucous membrane (glandular lining of the uterine cavity).

**Myometrium**, the smooth muscle forming the bulk of the uterus, giving rise to sarcomas. A tripartite, thick muscle.

**Perimetrium** (serosa).

The uterus has three openings, two from the tubes and the os of the cervix.

The 'cul de sac' is the empty space between the rectum and the uterus.

### Common histologies:

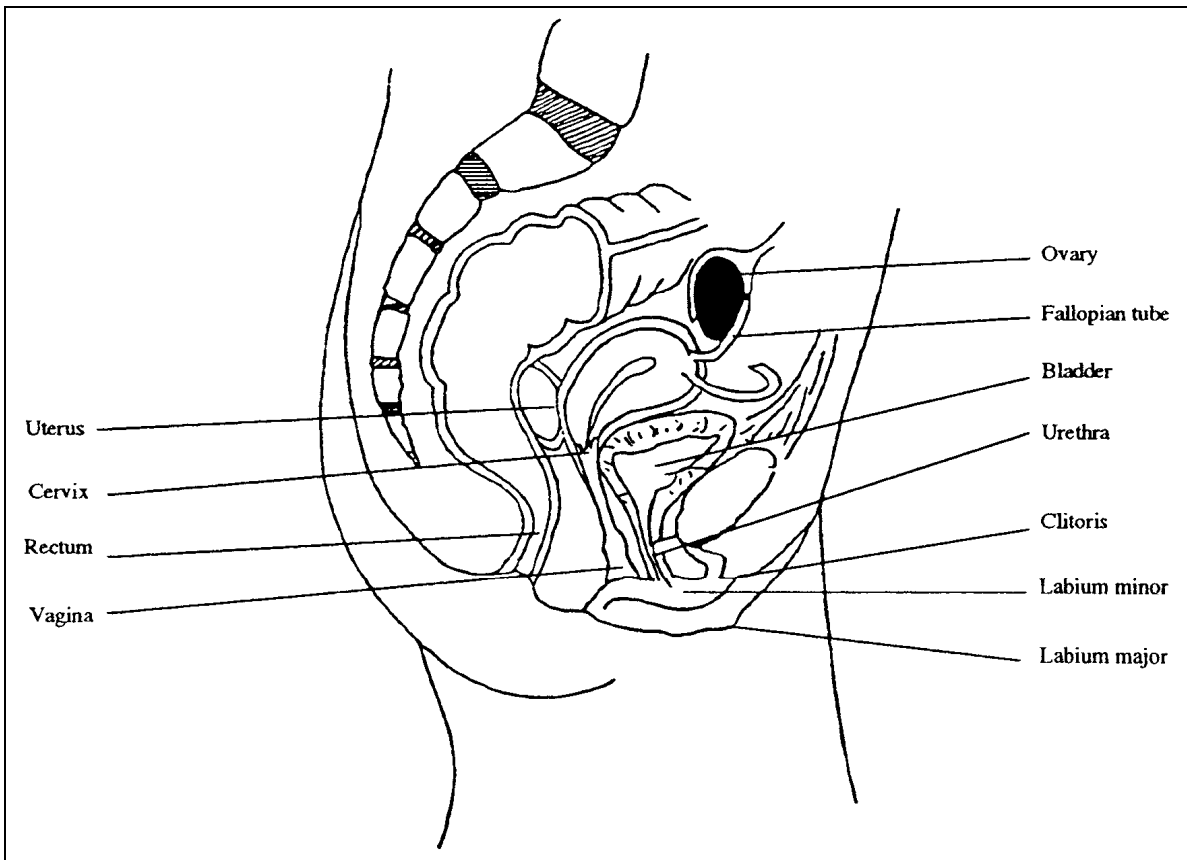
1. Adenocarcinoma and endometrioid carcinoma of the endometrium.
2. Sarcoma mesenchymal tumour arising from the endo- and myometrium.
3. Leiomyosarcoma arises from the smooth muscle of the myometrium; comprises the majority of the sarcomas of the uterus.
4. Mixed Mullerian sarcomas arise from glands and stroma and have no single histological pattern.
5. Adenoacanthoma has a benign squamous component; very curable malignancy.
6. Adenosquamous carcinoma.

7. Papillary carcinoma.
8. Hydatidiform mole is an abnormality of the placenta.
9. Choriocarcinoma is a gestational trophoblastic malignant neoplasm (composed of placental-type tissue) occurring in a hydatidiform mole.

**Regional lymph nodes**

1. Common, internal and external iliac
2. Sacral
3. Parametrial

**Female reproductive system**



**Ovary**

**Anatomy**

The ovary has three functional and anatomic components:

1. Surface epithelium
2. Germinal cells that produce ova

3. Stroma which is made up of sex cord and mesenchymal cells.

The ovaries are located on either side of the uterus below and behind the fallopian tubes.

**Common histologies:**

1. Mucoepidermoid ovarian carcinoma
2. Serous or mucinous cystadenocarcinoma

3. Germ cell tumours:
    - Dysgerminoma found in children and young adults
  4. Trophoblastic neoplasms:-
    - Choriocarcinoma of the ovary
  5. Gonadal stromal tumours:-
    - Granulosa cell
    - Theca cell
    - Sertoli-Leydig cell
  6. Brenner tumour
- NB. Krukenberg tumour is metastatic to the ovary, usually from a primary of the gastrointestinal tract, particularly the stomach.

## Fallopian tubes

### Anatomy

The walls of the fallopian tubes are composed of the same three tissue layers as the uterus except that the mucosa is ciliated to propel the ovum.

## Vagina

### Anatomy

It is composed mostly of smooth muscle lined with a mucous membrane of stratified squamous epithelium and connective tissue (stroma) arranged in rugae (ridges, wrinkles, or folds of mucous membrane).

### Common histologies:

1. Squamous cell carcinoma
2. Clear cell adenocarcinoma

## Vulva

### Anatomy

The external female genitalia consists of the following:

1. Mons pubis, skin covered fat pad.
2. Labia majora, covered with pigmented skin and hair on outer surface and smooth and free of hair on the inner surface.
3. Labia minora, located within the labia major
4. Clitoris, small organ composed of erectile tissue.
5. Urethral meatus, small opening of the urethra.
6. Vaginal orifice opening to the vagina.
7. Bartholin's glands, two bean-shaped glands on either side of the vaginal orifice which secrete a lubricating fluid.
8. Skene's glands, group of tiny mucous glands in the vagina.

The perineum is the area between the vagina and the anus.

### Common histologies:

1. Squamous cell carcinoma.



# The male reproductive system

## General anatomy

The male reproductive organs consist of two testes and a network of excretory ducts, seminal vesicles, the prostate, the bulbourethral glands and the penis.

The scrotum is a skin covered pouch of muscle supporting the structures of the male reproductive system.

## Prostate

### Anatomy

The prostate is located at the base of the bladder, surrounding the urethra.

The prostate has three lobes: the right and left lateral lobes and the middle lobe.

### Common histologies:

1. Adenocarcinoma
2. Microacinar

### Regional lymph nodes:

Internal iliac, sacral external iliac, and superficial inguinal.

## Testes (male gonads)

### Anatomy

Each testis consists of the tunica albuginea, a thick fibrous capsule encasing each testis, tiny seminiferous tubules and Leydig cells. Seminiferous tubules are the parenchymal tissue of the testes and they produce sperm cells.

Two types of sperm cells support and protect developing sperm cell:

- Spermatogenic cells
- Sertoli cells

The epididymis is a single coiled tube or duct on top of the testis which stores sperm cells after they leave the testis.

The vas deferens is an extension of the epididymis and carries sperm to the urethra.

### Common histologies:

1. Germ cell tumours the most frequent testicular tumours
  - a. Seminoma is the most common subtype of germ cell tumour
  - b. Teratocarcinoma is a malignant teratoma and germ cell tumour
  - c. Embryonal cell carcinoma
  - d. Choriocarcinoma is rare
2. Leydig cells and Sertoli cell tumours are non-germinal tumours arising from the gonadal stroma. They are seldom malignant.

## Penis

### Anatomy

Composed of connective tissue through which the urethra runs in the middle of the corpus spongiosus. Transitional cell carcinoma can arise here.

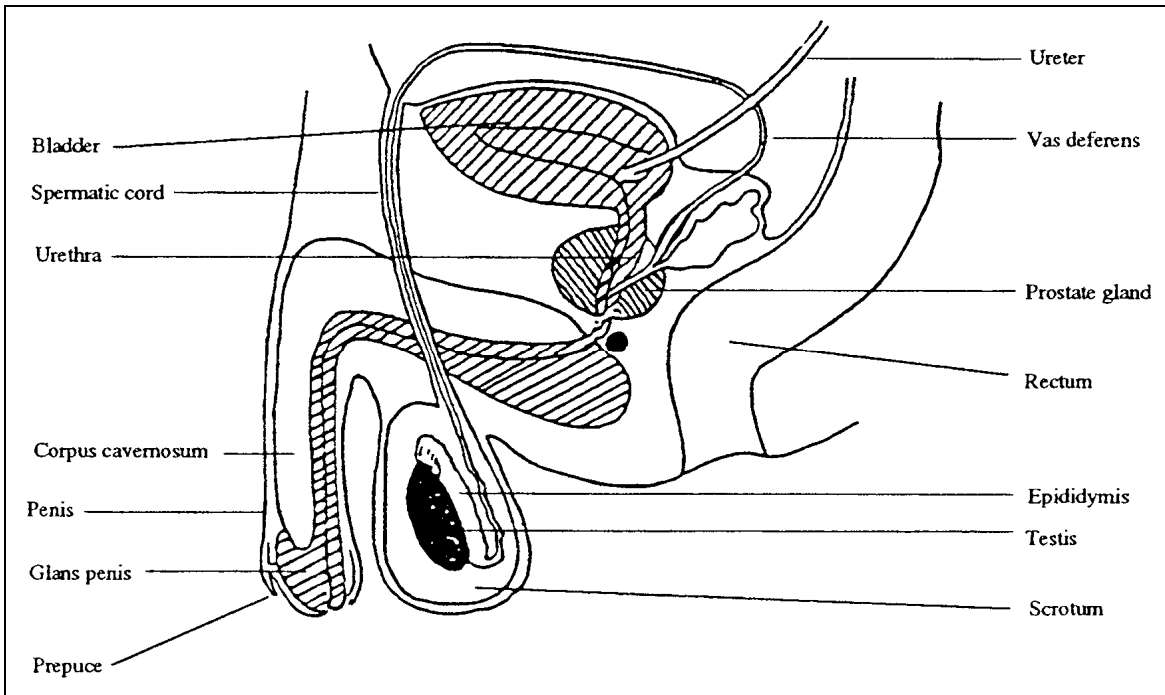
At the end of the penis is the glans penis covered by a reflection of the skin called prepuce. Squamous cell carcinoma usually arise here.

## Seminal vesicles

### Anatomy

Two glands located on the posterior surface of the bladder which secrete an alkaline substance that nourishes and provides a protective environment for the sperm cells.

### Male reproductive system



# The urinary system

## General anatomy

The urinary system in males and females consists of two kidneys, two ureters, the urinary bladder and the urethra.

## Bladder

### Anatomy

The trigone is a triangular area at the base of the bladder marked by the ureteric orifices and the urethra.

The bladder wall has three layers:-

**Inner layer** mucosa of the transitional epithelium and the lamina propria submucosa.

**Muscularis propria** is three layers of smooth muscle.

**Layer of peritoneum** (serosa) is on the superior surface only.

### Common histologies:

1. Transitional cell carcinoma
2. Squamous cell carcinoma and adenocarcinomas.

### Regional lymph nodes:

External iliac and obturator lymph nodes.

## Kidney and ureter

### Anatomy

The kidneys are located behind the peritoneal cavity (retroperitoneum) in the lumbar region.

The parenchyma is the functional, working elements of a kidney.

Gerota's fascia covers the kidneys.

The outer connective tissue layer of the parenchyma is called the cortex. The inner structure is called the medulla. Filtrate can be highly concentrated by the renal medulla.

The nephron is structural and functional unit of the kidney.

The calyces (plural form of calyx) are a cuplike organ or cavity in each kidney that collects urine and passes it on to the renal pelvis.

The renal pelvis is the central urine collecting structure of the kidney delivering urine to the ureters.

The ureters carry urine from the kidney to the bladder.

The urethra carries urine from the bladder.

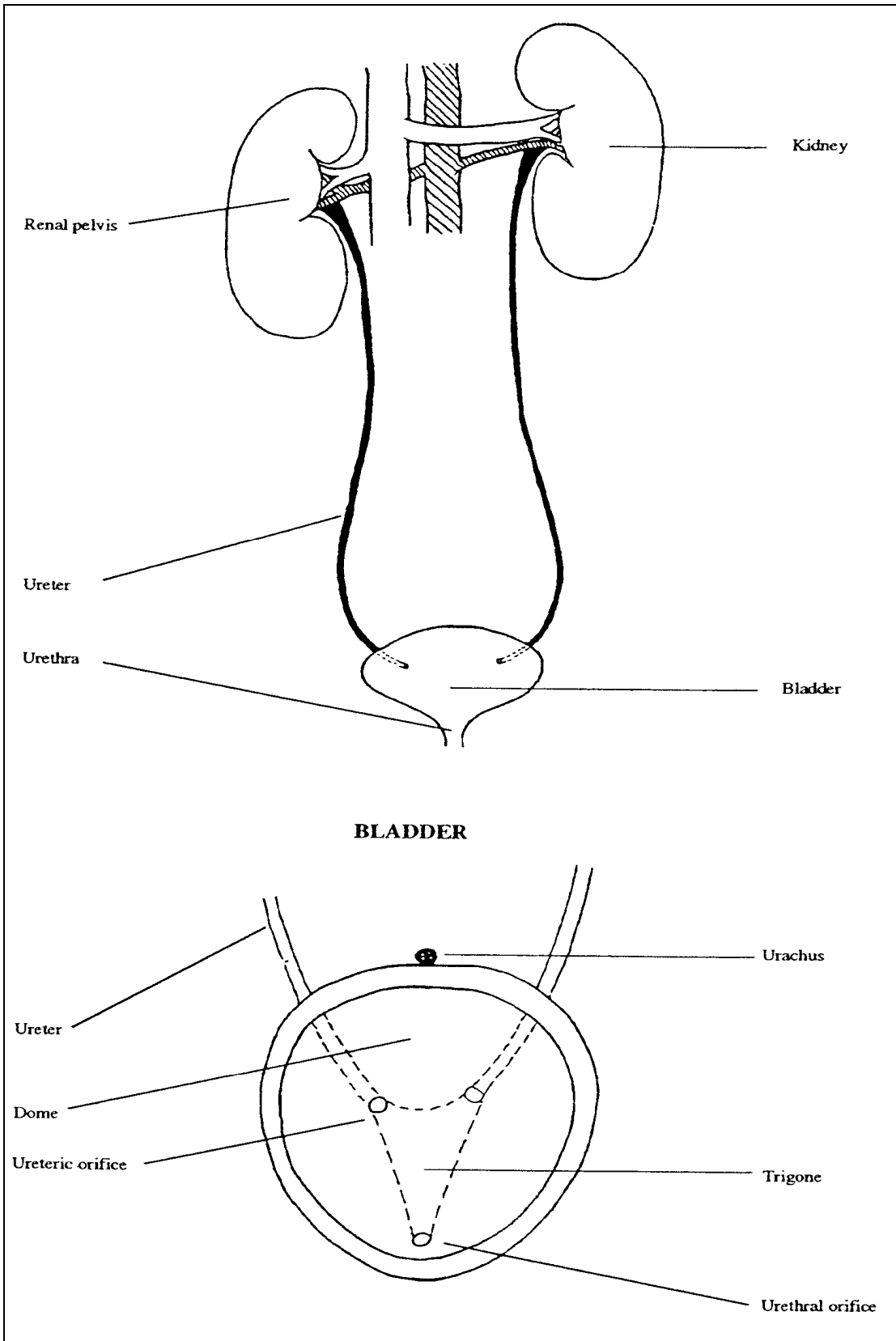
### Common histologies:

1. Adenocarcinoma (also known as hypernephroma, renal cell carcinoma and Grawitz tumour).
2. Transitional cell carcinoma, arising in and most common malignancy of the renal pelvis.
3. Wilm's tumour, nephroblastoma (childhood malignancy).
4. Clear cell carcinoma.

### Regional lymph nodes:

Hilar, paracaval, para-aortic, retroperitoneal.

### The urinary system



# The sense organs

## General anatomy

The five major senses are vision, taste, smell, hearing and touch.

Sense organs or receptors convert the energy of stimulus into a sensation or reflex.

There are three types of receptors based on their location:-

**Exteroceptors** are surface receptors, located in the skin, mucosa, eye and ear.

**Visceroceptors** are located in the walls of blood vessels in the stomach, intestines and various other organs.

**Proprioceptors** are located in muscles, tendons, joints, and the internal ear.

## Vision

### Eye

#### Anatomy

Three layers compose the eyeball: the sclera, choroid and retina.

1. The sclera consists of tough fibrous tissue and is the protective and supportive layer of the eye.
2. The choroid layer (the pigmented vascular coat) contains the following:-
  - a. The iris is the coloured muscular ring that controls the size of the pupil and therefore the amount of light entering the eye.
  - b. The main part of the ciliary body is the ciliary muscle which adjusts the lens for vision at different distances.
  - c. The crystalline lens is suspended from the inner surface of the ciliary body by (circular) suspensory ligaments. The function of the lens is to bend light rays in order to focus an image on the retina.

3. The retina is the innermost portion of the eye. It is composed mostly of nervous tissue and is the light-sensitive layer.

The eyeball is not a solid sphere. It is divided into large cavities. The canthus is where the upper and lower eyelids meet.

The lacrimal apparatus secretes tears. It consists of four structures:-

1. Lacrimal glands
2. Lacrimal ducts
3. Lacrimal sac
4. Nasolacrimal duct

These structures perform the functions of secreting and draining tears on the surface of the eyeball.

The accessory structures of the eye include the eyebrow, eyelashes and eyelid. The eyebrow and eyelashes serve a protective function. The eyelid is lined with a mucous membrane called the conjunctiva.

#### Common histologies:

1. Malignant melanoma in adults
2. Retinoblastoma in children. These arise from the retinal germ cells.
3. Epidermoid (squamous cell) carcinomas arise from the conjunctiva.

#### Regional lymph nodes:

The lymphatics of the eyelid are the submandibular, parotid, facial, and cervical. There are no true lymphatics associated with the eyeball.

## Taste

Taste buds are located on the tongue, palate, pharynx and epiglottis, but are most numerous on the tongue.

The four primary tastes are sweet, sour, bitter and salt. Other qualities of taste are a fusion of two or more primary tastes and the stimulation of olfactory receptors.

For anatomy and other information about the tongue, see the review of the digestive system.

## Smell

### *Anatomy*

The olfactory sense organs consist of hair cells in the mucosa of the upper part of the nasal cavity. They are stimulated by chemical stimuli.

The anatomy of the nose is discussed with the respiratory system.

## Hearing

### *Ear*

### *Anatomy*

The organ of hearing consists of three main parts:- the external, middle and inner ear.

1. The external ear collects the sound which is transmitted through the external auditory canal to the tympanic membrane (eardrum). The tympanic membrane transmits sounds to the inner ear.

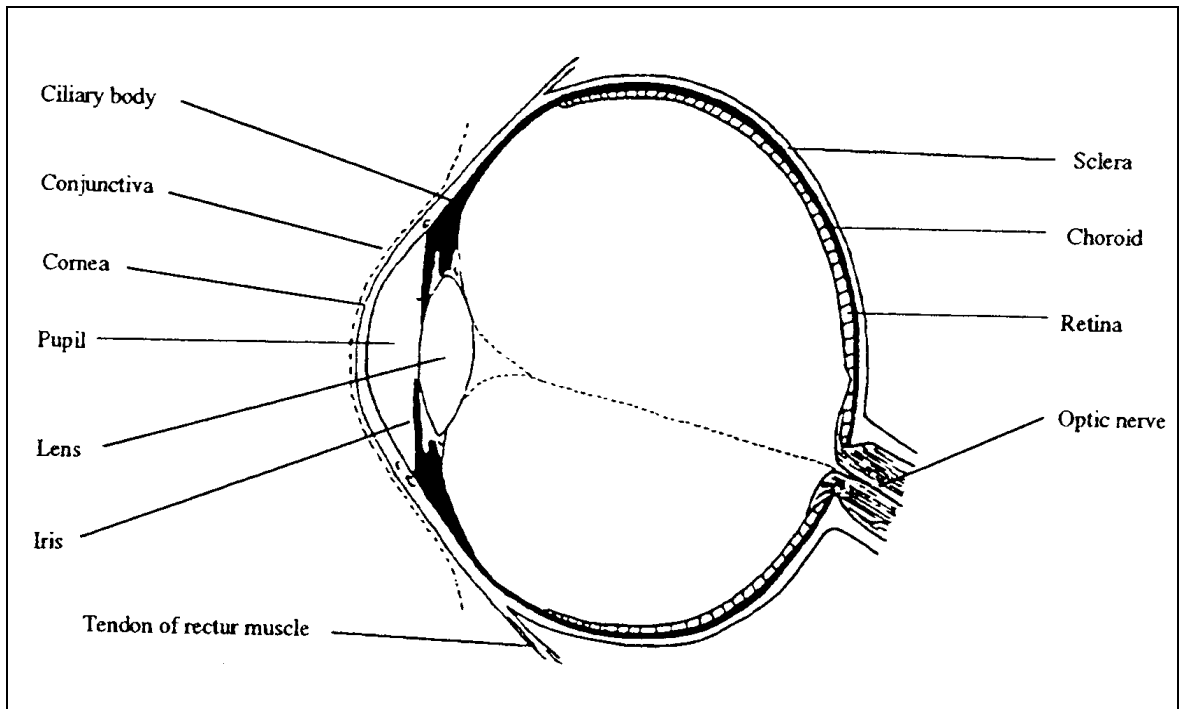
2. The middle ear lies in a cavity in the temporal bone. It is connected with the nasopharynx by the Eustachian tube which equalizes pressures on the eardrum. This opens with yawning or swallowing.
3. The inner ear is comprised of membranous tissue connected within a bony structure.

The bony labyrinth has three divisions: the cochlea, and the semicircular canals. The cochlea is a spiral canal containing the receptor for hearing called Organ of Corti. This has hair cells which pick up impulses transmitted from the inner ear.

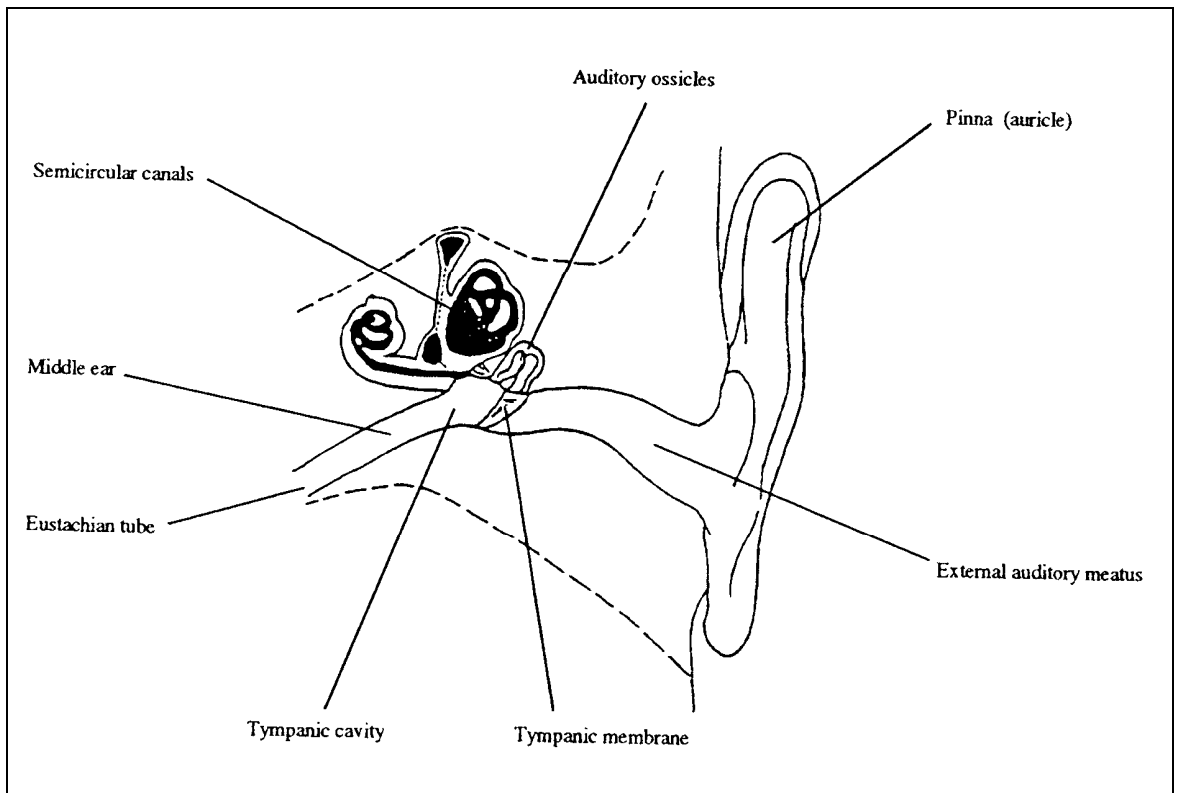
The semicircular canals help the body maintain its balance.

The small bones in the ear transmit sound waves from the eardrum to the fluid of the inner ear. They are the malleus, incus, and stapes.

**Eye**



**Ear**





# The nervous system

## General anatomy

The central nervous system consists of the brain, spinal cord and their coverings called meninges.

Nervous tissue is composed of three types of cells:

1. Neurons form the basic structural and functional unit of the nervous system.
2. Neuroglial (glial cells) provide the connective tissue for support and protection. Examples are microglia ependymal cells, oligodendrocytes and astrocytes.
3. Schwann cells form a sheath (neurolemma) covering the axons of peripheral nerve fibres.

## Brain

### Anatomy

The brain has three main divisions:

1. The forebrain consists of the cerebrum (telencephalon) and the diencephalon. The diencephalon includes the thalamus, hypothalamus and epithalamus.
2. The midbrain receives impulses from the eye and ear and connects the forebrain and hindbrain.
3. The hindbrain consists of the pons, the cerebellum and the medulla oblongata.

The meninges are composed of three membranes which surround the brain and spinal cord.

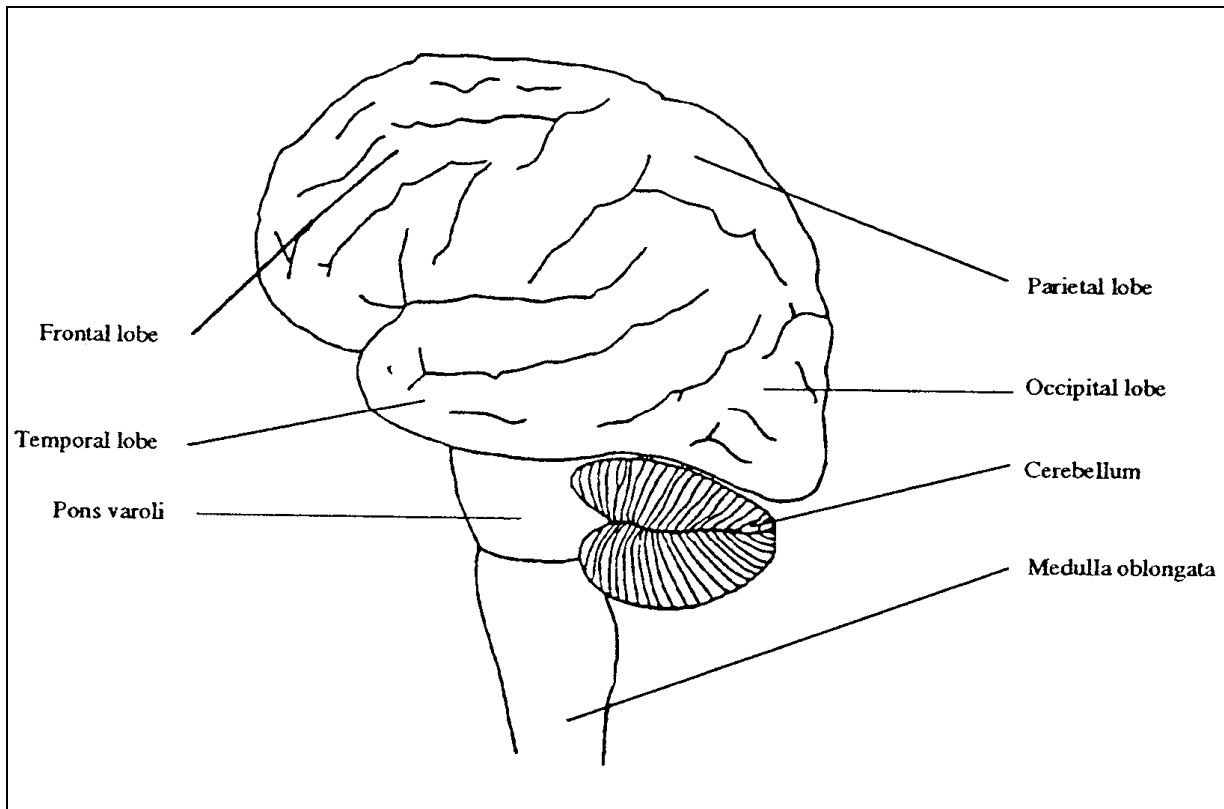
1. The dura mater lines the skull.
2. The pia mater is a thin innermost layer which covers the brain.
3. The arachnoid mater lies between the two and contains the blood vessels.

The choroid plexus are the vascular fringe-like folds in the pia mater of the cerebral ventricles that produce cerebrospinal fluid (CSF).

The sympathetic nerves are nerves of the autonomic nervous system.

Most central nervous system tumours arise in the neuroglial cells. Most brain tumours in adults are of glial origin and arise in the cerebrum.

## The brain



### Common histologies

1. Astrocytomas are of glial origin.
2. Glioblastoma.
3. Medulloblastoma: most common in the cerebellum of children.
4. Meningioma tumour of the membranes surrounding the brain and spinal cord. Slow growing and are frequently benign. Arise from cells in the pia arachnoid of the meninges.
5. Neurilemmomas develop from Schwann cells and are commonly associated with the 8th nerve.
6. Ependymomas arise from the ependymal cells which line the ventricles of the brain and central canal of the spinal cord.

*N.B. Many brain tumours are metastatic from another primary site.*

# The endocrine system

## General anatomy

The endocrine system is comprised of ductless glands which release hormones directly into the blood stream.

Exocrine glands release their secretions into ducts (tear, digestive and sweat glands).

Endocrine glands discussed in other sections include the Islets of Langerhans (see section on the digestive system) and the ovaries and testis (discussed with their respective reproductive systems).

Hormones are organic secretions originating in a ductless gland and conveyed to another part of the body by the bloodstream.

## Thyroid

### Anatomy

The thyroid consists of two lateral lobes united by a strip of glandular tissue called the isthmus. The unit structure is the follicle.

The thyroid is located on either side of the trachea just below the thyroid cartilage.

### Common histologies

1. Papillary carcinoma, well differentiated.
2. Follicular carcinomas.
3. Medullary carcinomas.
4. Hurthle cell carcinoma of the thyroid is composed of large (Hurthle) cells. They only differ from non-Hurthle cell tumours in their histological staining characteristics. Usually benign, but may be locally invasive.

5. Anaplastic cell carcinoma, undifferentiated carcinoma of the thyroid.

## Adrenal glands

### Anatomy

Two adrenal (suprarenal) glands are located on top of the kidneys and behind the peritoneum. Each has two parts, the outer cortex and the inner medulla.

### Common histologies:

1. Neuroblastomas arise from the medulla.
2. Phaeochromocytomas and ganglioneuromas are tumours of the adrenal medulla.
3. Adenocarcinoma arises in the adrenal cortex.

## Parathyroid glands

### Anatomy

There are four parathyroid glands located adjacent to the thyroid gland. Occasionally they will be in the mediastinum.

### Common histologies

1. Tumours of the parathyroid are usually benign adenomas or hyperplasia.
2. Carcinomas occur occasionally.

## Pituitary gland

### Anatomy

The pituitary gland is controlled by the hypothalamus of the brain and it links the nervous system to the endocrine system.

Located in the sella turcica near the base of the brain. Referred to as the master gland since it controls all secretions of hormones in the body.

### ***Common histologies***

1. Most pituitary tumours are benign adenomas.
2. Craniopharyngioma (Rathke's pouch tumour) arises along the craniopharyngeal duct.

## **Pineal gland (*Epiphysis Cerebri*)**

### ***Anatomy***

Located in the brain, it is attached to the third ventricle. The pineal gland synthesizes the hormone melatonin which contributes to the process of skin pigmentation.

### ***Common histologies***

1. Tumours are called pinealomas and are usually benign.

## **Thymus gland**

### ***Anatomy***

The thymus gland is located behind the sternum in the mediastinum. It is large in children and shrinks in adults. Its structure is lymphoepithelial and it is a source for T-lymphocytes that are involved in cell-mediated immunity.

### ***Common histologies***

1. Tumour of the thymus are called thymoma.

# Quiz

## Just for Fun Quiz 1 – common neoplasm terms

Write the definition of each term in the space provided.

No	Term	Definition
1	Carcinogens	
2	Benign	
3	Metastasise	
4	Microinvasion	
5	Stage	
6	Transitional cell carcinoma	
7	Chemotherapy	
8	Pathology	
9	Remission	
10	<i>In situ</i>	
11	Oncology	
12	Secondary	
13	Uncertain/unknown behaviour	
14	Oncogenes	
15	Malignant	
16	Neoplasm	
17	Primary	
18	Adenocarcinoma	
19	Radiotherapy	
20	Palliative	
21	Occult	
22	Lesion	
23	Lytic lesion	
24	Hot spots shown on CAT scan	
25	Deposits	

## Just For Fun Quiz 2 – referral letter

Identify and explain any medical terms, abbreviations and symbols.

Dear Dr Clever,

Thank you for seeing Mr Unlucky, who was involved in an RTA and brought into casualty. His DOB is 01/04/56.

O/ E he was very SOB and rather uncooperative. He had a CT and MRI scan.

These showed that he had a # manubrium and lacerations to the lateral region of his chest. He is also acutely tender over his L4 region and I am not sure if this is as a result of the RTA or 2° to an operation he had to remove an osteoma when he was 12 years old.

His TPR were all a little raised on admission. Other investigations included FBC, CXR, and ECG.

Two years ago he was Δ with NIDDM and is receiving the appropriate medication. He was noted to have splenomegaly and dyspnoea and reported to have IC being able to walk only 100 metres.

His Hb and ESR levels were normal but much to our surprise he was seen to have a SOL which showed on the MRI scan.

PMH includes - 1980 hemi-colectomy for crohn's disease  
-- 1982 hypertension  
- 1987 CABG

- NIDDM
- Laryngitis
- Tracheotomy
- COAD

DH includes - NSAID

- aspirin

I trust he will do well in the future,

Yours sincerely

Dr I M Caring

