NEOPLASIA (= new growths)

Oncology is the study of tumours. The word tumour means swelling, either benign or malignant. Tumours are often described by their tissue of derivation followed by -oma. For example meningiomas are derived from brain meningeal tissue. Neoplasms may be:

- Cancers, derived from endoderm or ectoderm
- Sarcomas, derived from mesoderm "connective tissue"
- Leukaemias from white blood cells
- Lymphomas from monocytes or macrophages

Both benign and malignant tumours may:

- Grow locally
- Cause pressure effects on surrounding tissues
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but malignant tumours also:

- Invade surrounding tissues
- Metastasize (migrate to form satellite tumours) to other sites. The lung or liver are typical sites

Factors in the development of malignancy include:

- The external environment - smoking, pollution, chemicals, diet, radiation (including sunlight)
- The internal environment - hormones, drugs, free radicals
- Genetic - some malignancies are more common in near relatives. Certain genes (oncogenes) are known to predispose to various malignancies. Some oncogenes can be inserted by retroviruses
- Infections - Human immunodeficiency virus predisposes to Kaposi's sarcoma, certain papillomaviruses predispose to cancer of the cervix, and hepatitis C and B predispose to liver cancer (indeed liver cancer can be prevented by preventing hepatitis B infection: liver cancer was the first cancer to be prevented by immunization)
- "Life factors" - early age of onset of periods, late age of first pregnancy and late age of menopause are associated with an increased risk of breast cancer. The more babies a woman has had the less is the chance of carcinoma or uterus, ovary or breast

There are difficulties in identifying the cause of a cancer in individuals. Exposure of a population to a known carcinogen may cause an increase in certain malignancies (thyroid cancer after Chernobyl for example) but it is impossible to say that one individual's thyroid cancer was caused by such exposure. Similarly clusters of malignancies may occur which might either reflect the fact that coincidental clusters are a statistical certainty or which represent a valuable clue to a shared causative factor (even strong associations do not necessarily represent a causal relationship).

About one in three people die of malignant neoplasms. Most of those who die are over the age of 60 but malignant neoplasms are a leading cause of death in childhood.

In general neoplasia occurs when control of genes fails (neoplastic cells almost always have abnormal chromosomes). Cells often become malignant but are immediately destroyed by the body's immune defenses. Genetic changes underlying malignancies are usually multiple. If this were not so, the incidence of most neoplasms would increase linearly with age (the incidence of some "single genetic change" neoplasms, for example retinoblastoma, a genetic tumour of the eye) do increase with age.

Differentiation between benign and malignant neoplasms can be made, often too late, on clinical grounds but for early presentations microscopic *grading* is almost always required. Malignant neoplasms are more likely to show:

- Variable cell size
- Abnormal nuclei
- Increased mitoses
- Evidence of invasion

Cultured malignant cells tend to be spherical - probably caused by an abnormally low number of structure determining microtubules (page 00).

Malignant neoplasms can be clinically *staged* using various criteria including the degree of spread. Other means of diagnosis utilize:

- Immune methods often using a monoclonal antibody (an antibody made in the laboratory from one clone of identical cells which produce an antibody that will stick only to its target). If such an antibody is labeled it can be used to reveal malignant cells
- Tumour markers are substances produced by neoplasms (some of which may exert effects away from the tumour) but unfortunately the sensitivity of such tests tends to be inversely proportional to the specificity: nevertheless in proven neoplasia of certain tissues they can be used to monitor the efficacy of therapy

Malignant cells, almost like an infecting organism, need to adhere to host surfaces and then to invade. If neoplasms cannot do this they do not spread and are microscopically benign (although benign neoplasms may cause debility and death because of "malignant" positioning).

In cell culture malignant cells multiply at the same rate as do normal cells. Malignant cells grow like cells that have reverted to a unicellular type existence in that they lose contact inhibition (slowing of growth when compacted with similar cells) as shown by normal cells and they lose built-in mortality (page 00) and in effect become immortal. The interesting question is "How does the immune system control cells in the first place?"

Malignant cells almost always have chromosome abnormalities.

Treatment of tumours:

- Prevention by screening, early detection and, in some cases, by vaccination
- Radiotherapy
- Chemotherapy
- High-dose chemotherapy with total destruction of malignant tissue followed by transplantation
- Surgery
- Immune system manipulation
- Palliation
- Combinations of the above