Cancer Biology

School of Biosciences

College of Life and Environmental Sciences

Details

Code 21893

Level of study Third/Final year

Credit value 20

Semester 2

Module description

Cancer is a major cause of morbidity and mortality. An understanding of normal and cancer cell biology is essential if progress is to be made in the treatment of this disease. This module is concerned with understanding the cellular and molecular biology of cancer and described below are the main areas covered in this module.
Major advances in our understanding of cancer have occurred as a result of biochemical and genetic investigations of a wide range of organisms. These have revealed a core set of biochemical mechanisms which are highly conserved between species. The essential elements include specific extracellular signals which coordinate cell proliferation by activating specific signalling pathways inside the cell. These pathways converge upon the transcriptional activation of a number of genes whose activity is required to induce the processes leading to the replication of DNA and subsequent completion of the cell cycle.
An essential feature of the cell cycle is that events need to be ordered in time and some processes, such as DNA synthesis, need to be completed before others, such as mitosis, begin. This is coordinated by a set of protein kinases - the CDKs - whose activity is controlled by association with specific regulatory subunits - the cyclins.

Analysis of genetic alterations that occur in the formation of tumours has revealed a class of genes known as tumour suppressor genes which play a fundamental role in normal cell multiplication. Detailed analysis of two such genes p53 and Rb, suggest that they have a ‘gate-keeping’ function which prevents progress through the cell cycle. A key aspect of tumour suppressor gene function is the response to DNA damage. Loss of tumour suppressor gene function permits cells to proliferate under conditions where their normal counterparts cannot.
It is the spread of tumour cells from the primary tumour to other sites in the body – a process known as metastasis – that is a frequent cause of death in patients with cancer. Much effort is being directed towards understanding metastasis with the aim of targeting therapies to either prevent metastasis or to cause regression of metastatic tumours.
For a tumour to establish and grow it needs to establish a blood supply – a process known as angiogenesis – and disrupting this blood supply has long been a potential target for therapy.
Recent advances in our understanding of the molecular and genetic basis of cancer have spawned a new era in cancer therapy. New therapies are being developed that are selective and have reduced toxicity. However, despite some successes, rates of new drug discovery remain very slow and the costs are high. This means that we must be certain that we are making the best use of drugs that are already available. Many, if not all, tumours are maintained by a discrete population of cells that can be termed cancer stem cells. These cells have separate properties from their progeny that make up the bulk of the tumour. Successful long-term eradication of cancer is dependent on the targeting of these cells.