SUMMARY:
This module will review current knowledge, underpinning principles and recurrent themes in the field of molecular cancer cell biology. We will discuss in detail the regulatory pathways governing cell cycle commitment and progression, and their disruption in cancer cells. DNA damage, surveillance checkpoints and repair pathways will also be discussed in the context of hereditary cancer susceptibility syndromes, leading on to the emerging molecular description of nuclear organization in cancer cells. The module will also outline current knowledge of cancer stem cells, the mechanisms and principles underlying metastasis, and the value of experimental model systems used to study the development and spread of cancer. It will end with an overview of personalized approaches to cancer diagnosis and therapy and explain what we can and can’t do with the wealth of information that is now available.

LEARNING OUTCOMES:
Successful completion of this module will result in an understanding of
- The Hallmarks of cancer
- The pathways that govern cell cycle commitment and progression
- Their disruption in cancer cells and the concepts of oncogenes and tumour suppressors
- DNA damage, repair and surveillance pathways that protect the genome
- Nuclear organization and its disruption in cancer cells
- The principles underlying the spread of cancers
- Aberrant adult stem cell activity and its contribution to tumour formation
- Current approaches in cancer research
- Modern approaches to cancer diagnosis and therapy, and the promise of personalized medicine.
## SYNOPSIS OF TEACHING:

<table>
<thead>
<tr>
<th>Event</th>
<th>Duration (Hrs)</th>
<th>Topic</th>
<th>Staff</th>
<th>Room type</th>
<th>Timing</th>
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<tbody>
<tr>
<td>Lecture 1</td>
<td>1.5</td>
<td><strong>The Hallmarks of Cancer.</strong> This introductory lecture will give an overview of the multiple cellular pathways that must be disabled for a normal cell to develop into a life threatening cancer. It will introduce the topics to be covered in later lectures and outline the focus of the cancer researchers who will summarize their fields in later lectures.</td>
<td>DC</td>
<td>Lecture room</td>
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<td>Lecture 2</td>
<td>1</td>
<td><strong>G1 control and passage through the restriction point.</strong> This lecture will include a detailed discussion of commitment to the cell cycle, assembly and activation of the DNA replication machinery and the effect of well-known oncogenes on this transition.</td>
<td>DC</td>
<td>Lecture room</td>
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<td>Lecture 3</td>
<td>1</td>
<td><strong>DNA damage and repair I</strong> An overview of the effect of environmental DNA damaging agents, and repair pathways.</td>
<td>DC</td>
<td>Lecture room</td>
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<td>Lecture 4</td>
<td>2</td>
<td><strong>DNA damage and repair II.</strong> Focus on checkpoint responses and integration of DNA repair with the cell cycle, to include discussion of gene products that are commonly mutated in cancer susceptibility syndromes and common, early somatic mutations that promote cellular transformation.</td>
<td>DC</td>
<td>Lecture room</td>
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<td>Lecture 5</td>
<td>1.5</td>
<td><strong>Dynamic organization of the nucleus</strong> This lecture will outline historical use of nuclear morphology to diagnose and classify tumours, moving to the emerging molecular understanding of aberrant structure. It will also introduce concepts and current research into the functional organization of the mammalian nucleus.</td>
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<td>Lecture 6</td>
<td>1</td>
<td><strong>Cancer Stem Cells</strong> This lecture will give an overview of the properties of adult stem cells, the concept of a tumour-initiating cell, and discuss differing hypotheses of carcinogenesis. It will show how genomic structure and expression profiling can provide clues to the origin of tumours that explain their response to common treatments, and ask whether we can develop therapies that take account of the existence of cancer stem cells.</td>
<td>NJM</td>
<td>Lecture room</td>
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<tr>
<td>Lecture 7</td>
<td>1</td>
<td><strong>Tumour microenvironment, invasion and metastasis I</strong> Discussion of this topic will begin with an overview of the heterogeneous cellular population in the tumour microenvironment, and how this relates to cancer progression. Heterotypic interactions between tumour cells</td>
<td>WB</td>
<td>Lecture room</td>
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and the various types of stromal cells will be discussed in relation to angiogenesis, epithelial-mesenchymal transition, and invasion.

| Lecture 8 | 1 | **Tumour microenvironment, invasion and metastasis II**  
The second lecture will focus on the subsequent local spread of tumours, and the multi-step metastatic cascade by which cancer cells disseminate to form secondary tumours at distant sites. The latest experimental models that inform our current understanding of invasion and metastasis will be discussed. | WB | Lecture room |

| Lecture 9 | 1 | **Modern approaches to diagnosis and therapy**: This lecture will summarize what we can do with the wealth of information being generated. It will include an overview of large-scale cancer genome projects, post-genome approaches to the diagnosis and treatment of cancer and the promise of personalized medicine. | DC | Lecture room |

**KEY TEXTS**: These are available in EARL which is accessible through the VLE module site.

**ASSESSMENT**:

Formative: No

Summative: 2 hour closed examination paper

Re-assessment: 2 hour closed examination paper

**MAXIMUM NUMBERS**: limited by lecture room

**STUDENT WORKLOAD**: students’ workload totalling 100 hours per 10 credit module

Lectures: 9

Workshops: Supported learning sessions

Practicals: Tutorials

Total Contact hours: 11

Assessments (formative and summative): 2

Private study: 87