An introduction to cancer biology, targeted therapies, and immunotherapies for cancer

An introduction to the biology of cancer, the faulty genes that drive its behaviour, and the science behind systemic treatments including immunotherapies and precision medicine.

Course overview

This course introduces the genetic damage and immune system changes that cause cancer. It describes the rationale behind a diverse range of targeted drug treatments and immunotherapies available today.

Dr Elaine Vickers – a leading independent educator on the science of new cancer treatments – translates complex and often overwhelming topics into easily digestible and understandable knowledge.

The course comprises a series of five, one-hour long sessions delivered online via Microsoft Teams:

- **Session 1:** Cancer biology and genetics
- **Session 2:** Targeted cancer treatments
- **Session 3:** Introduction to immunotherapy
- **Session 4:** Immunotherapy with checkpoint inhibitors
- **Session 5:** Targeted treatments and immunotherapies for haematological cancers

Detailed description

Session 1: Cancer Cell Biology & Genetics

- A refresher of cancer as a disease caused by DNA damage in individual cells
- DNA damage in cancer cells:
  - Causes, types and patterns of DNA damage
  - The consequences of that damage in terms of cell behaviour
- The constantly changing nature of cancer:
  - Why and how cancer cells evolve and change over time
  - The importance of intratumoural heterogeneity
  - Composition of the cancer microenvironment and the importance of white blood cells
  - Why some cancer cells can cause metastasis and others can't

Session 2: Targeted Cancer Treatments

- Introduction to targeted therapies – what are they?
- If they're so targeted, why do they cause side effects?
- Antibody-based treatments:
  - Structure of antibodies & why antibodies are used to treat cancer
  - Targets of antibody-based treatments

    - Mechanisms of action of naked antibodies, drug-conjugated antibodies, bi-specific antibodies, bi-specific T cell engagers, CAR T cells
- Small molecules that block kinase enzymes:
    - What are kinase enzymes and why are they important?
    - Examples of over-active kinases in cancer cells (e.g. growth factor receptors, signalling proteins, CDKs, fusion proteins)
    - Mechanism of action of kinase inhibitors
- Small molecules with other targets (e.g. PARP & Bcl-2 inhibitors)
- Who do we give targeted therapies to, and why don't they always work?

Session 3: Introduction to Immunotherapy

- What is immunotherapy?
- The relationship between cancer and the immune system:
    - Elimination, equilibrium, escape
    - How cancer cells "hide" from the immune system
    - Good guys and bad guys – the behaviour of different white blood cells found in tumours
- T cells: the key to modern immunotherapy
    - Introduction to T cells
    - The cancer-immunity cycle
    - Overview of immunotherapy approaches
- Checkpoint proteins and checkpoint inhibitors
    - Introduction to checkpoint proteins
    - Mechanism of action of checkpoint inhibitors

Session 4: Immunotherapy with checkpoint inhibitors

- Who are checkpoint inhibitors licensed for?
- Some lessons learned from trials:
    1. PD-1 and PD-L1 antibodies are PROBABLY equally effective
    2. They have the potential for long-term disease control
    3. The earlier you can give the checkpoint inhibitor the better
    4. Responders to monotherapy are usually in a minority
    5. Response rates are highest in tumours with PD-L1/2 gene mutations
    6. Combinations boost response rates and survival times, but at what cost?
    7. Early trial data can be misleading
- Biomarkers of response and resistance:
    - PD-L1 levels; tumour mutation burden; microsatellite instability
    - The microbiome and other patient factors

Session 5: Targeted Treatments and Immunotherapies for Haematological Cancers

- Why are treatments for haematological cancers different to those for solid tumours?
- Antibody-based treatments for haematological cancers:

  - Using antibodies to attract macrophages and NK cells
  - Novel approaches: antibody-drug conjugates; bi-specific T cell engagers & bi-specific antibodies
- Small molecule kinase inhibitors:
  - Those targeting growth factor signalling pathways (e.g. FLT3, JAK)
  - Other kinase targets (e.g. Bcr-Abl, BTK)
- Small molecules with non-kinase targets (e.g. Bcl-2)
- Cell based therapies: CAR-modified T cells

About Elaine Vickers

Dr Elaine Vickers, PhD of Science Communicated Ltd has worked as a cancer educator for over twenty years and has previously acted as science communicator for three of the UK's leading medical research charities, including four years in the Science Information team at Cancer Research UK.

She is passionate about demystifying the science behind cancer biology and the latest cancer treatments such as kinase inhibitors, monoclonal antibodies and immunotherapies. Elaine is experienced in teaching people with any level of scientific or medical knowledge from cancer patients through to medical oncologists.

Her book, A Beginner's Guide to Targeted Cancer Treatments, was commended by the British Medical Association book awards. A second edition is due out in 2024.