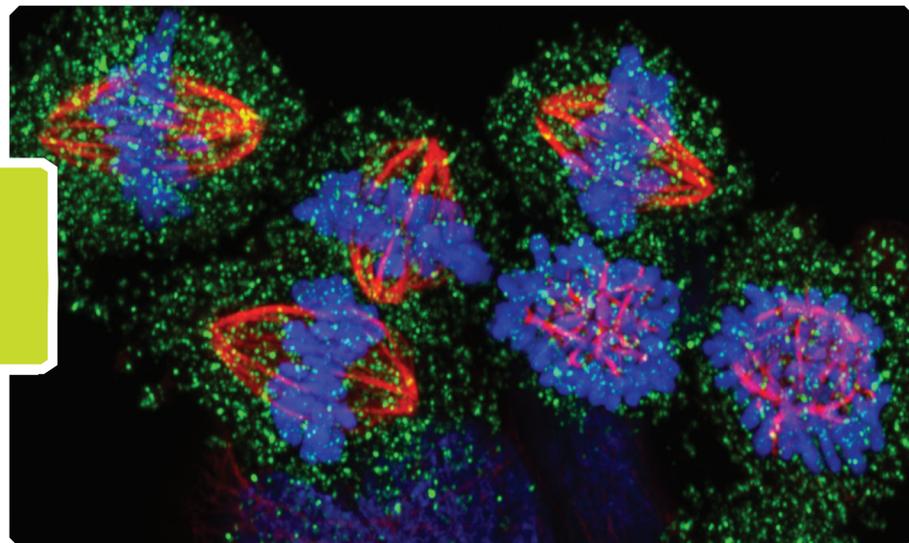


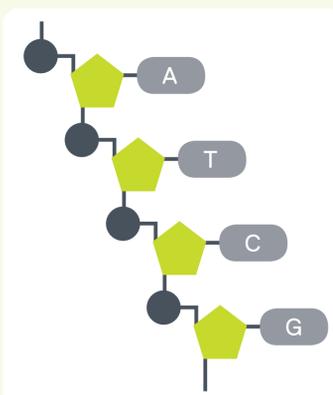
DNA and cancer



The Institute of Cancer Research, London, was the first place in the world to realise that cancer is caused by damage to DNA.

We now know that cancer is a genetic disease caused by faults – mutations – in our DNA.

What is DNA?



DNA is a large, complex molecule, found in the nucleus of our cells.

It's a polymer – built up of component parts called nucleotides. Each holds an A, T, C or G base, and together these bases are the alphabet that writes the genetic code.

There are three billion of these bases in each copy of your DNA!

The sequence of bases spells out the instructions for making proteins – and your proteins do pretty much everything else to make your cells, and your body, work.

How mutations drive cancer growth

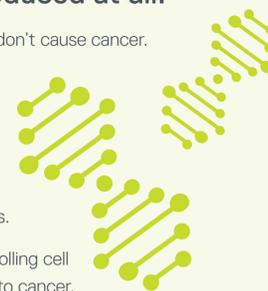
Any mistakes in the DNA can affect the way proteins are made – potentially meaning a protein no longer works properly, or even that it is no longer produced at all.

Mutations are happening in your cells all the time, and usually they don't cause cancer.

- Mostly the DNA repairs itself before any damage is done.
- Or the mutation will have no impact on the protein or the cell.
- Or the mutated protein will have no cancer-causing effect.

We build up mutations in our cells as we get older, and usually need to collect many mutations within a cell before it becomes cancerous.

If a protein is particularly important – especially in an area like controlling cell division, or repairing faults in the DNA – a single mutation can lead to cancer.



Using what we know to defeat cancer

Acquired mutations

The mutations that arise throughout our lifetime are the most common cause of cancer. They can be caused by the environment, or by behaviours such as smoking.

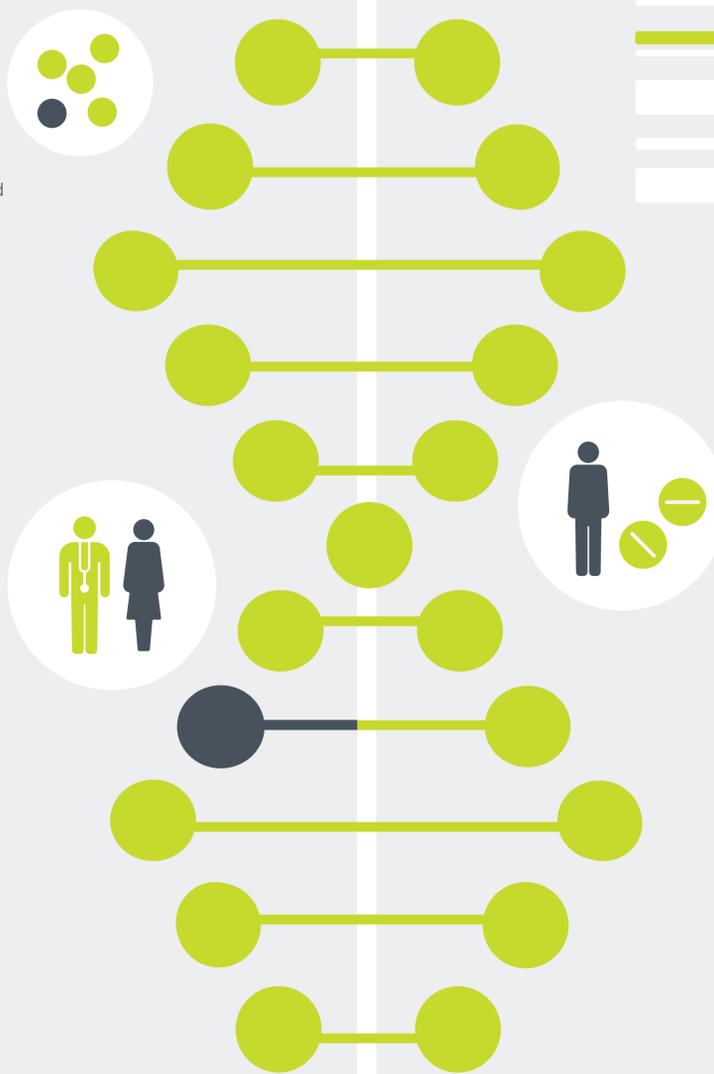
At The Institute for Cancer Research (ICR) we look at cancers to find what mutations they have.

We use our knowledge of these mutations to design targeted therapies – drugs that will interact with the specific cancer-causing faults in the tumour.

Helping patients

The ICR discovered that a gene called BRAF, involved in the signals that control cell growth, was mutated in some cancers, and could drive cancer development.

Our work on the gene and the protein it codes for underpinned the discovery of drugs that inhibit the mutant BRAF protein. One example is vemurafenib, which is available for patients on the NHS.



Susceptibility genes

Some inherited genes can increase our susceptibility to getting cancers. For example, some genes work to protect against cancer by correcting DNA damage. If you inherit a faulty copy of these genes, your cells might be more susceptible to cancer as they can't repair the faults.

Doctors can use this knowledge to predict who is at increased risk of developing cancer and help them with prevention or surveillance. In some cases, we can also use this information to decide the best treatment, targeting drugs at patients who have inherited a faulty gene.

Helping patients

The ICR discovered the BRCA2 gene, one of the first cancer susceptibility genes to be found.

The BRCA2 gene is involved in repairing damaged DNA. Women with certain BRCA2 mutations have an increased risk of breast and ovarian cancer. Women around the world now receive BRCA testing so that those with faulty genes can receive monitoring or preventative treatment for breast cancer.

Work at the ICR underpinned development of a type of drug called PARP inhibitors, which target weakness in DNA repair in patients with BRCA mutations. These drugs are now transforming the outlook for women with BRCA-mutant ovarian cancer.

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