Cancer Council WA

Fact Sheet

GENETICS AND CANCER.

Genetics is an exciting field of science in the cancer area. It may have implications for the diagnosis, prognosis and treatment of cancer. However there is still a long way to go, and many questions in the genetic field remain unanswered.

What are genes?

Our bodies are vast collections of cells. Each cell has a nucleus which contains 23 pairs of chromosomes which we inherit from our parents. Chromosomes are made up of thousands of genes, which are the basic units of inheritance, and genes are made up of DNA (deoxyribonucleic acid). Each gene determines a single human characteristic and together they contain all the information that controls how our bodies work, and how we look. For example, genes may determine whether we have brown or blue eyes, dark or fair hair.

Changes in genes may cause cancer

Of the 23,000 genes within a human cell, only a handful are known to regulate cell growth and division. Every time a cell divides, the chromosomes also reproduce so that each cell has the same genetic information. Sometimes, a mistake can happen when the chromosomes are copied, during cell division. In some cases this may be the first step that could lead to abnormal cell growth or cancer.

DNA can also be damaged by exposure to carcinogens such as ultraviolet radiation from the sun, tobacco (smoking) and asbestos.

Mutations are abnormal changes in the DNA of a gene

Most cancers occur due to changes in our DNA that happen during our lifetime. This is known as a 'somatic' mutation. Defective genes can also be inherited, or passed on, from parents to children, though only a small proportion of cancers (about 5 per cent) occur for this reason. Mutations passed through a family, are known as 'germline' mutations and they affect every cell in the body as they are already present when you are a single-celled embryo.

What is genetic pre-disposition?

Cancer can occur in families. Genetic make-up is passed on from parents to children. In families with known germline mutations, each child has a 50 per cent chance of inheriting the cancer susceptibility mutation. However having a gene mutation does not necessarily mean that a person will develop cancer and, mostly likely a trigger or promoter is also required for cancer to develop.

How do I know if the cancers in my family are inherited?

Increasing age is a risk factor for cancer; older people are more likely to develop a cancer. The majority of these cancers are chance happenings. Many families will have at least one relative who has experienced a cancer diagnosis and this does not necessarily indicate a hereditary risk.

A family cancer syndrome is where specific types of cancers occur in a family, and usually occur at a younger age than seen in the general population. These may be referred to as familial cancers. The first step to assessing familial cancer risk is to look at the number and types of cancers in your family. Collect a comprehensive extended family history noting those who have had a cancer, their age at diagnosis, and the type or location of the cancer.

Share this information with your general practitioner for further advice.

Familial cancers, account for just a small percentage of all cancers. Less than one in 20 people affected by cancer have inherited a gene with mutations.

The following features suggest a hereditary disposition to develop cancer:

- family member affected at a relatively young age (eg less than 50 years old)
- multiple cancers in one affected individual; and
- several family members on the same side of the family affected.

Can I be tested to see if I have a cancer gene?

At the moment genetic testing is only available on a limited basis to individuals with a strong personal or family history of cancer. Testing can also be offered to blood relatives when a mutation has been identified in another affected family member. One advantage to knowing your inherited risk for cancer is it allows you to undergo special surveillance (additional testing or medical check ups), to improve the chances of detecting cancer early when it is still potentially curable.

Genetic counselling is offered before and after genetic testing to discuss the medical, social and emotional implications for an individual and their family. Testing can only be done with prior assessment and counselling at a recognised genetic centre. In some cases it is not always possible to detect an altered gene in the family. However, a regular surveillance program may be recommended to monitor some individuals, based on their family history and assessed risk of developing cancer.

Will genetic research improve treatment?

Already over 2,500 gene therapy clinical trials have been completed worldwide. In addition, there are currently over 600 approved clinical gene therapy trials running worldwide.

Gene therapy may be used to replace a faulty gene or introduce a new gene whose function is to cure or modify the course of a disease. However, this form of therapy remains an experimental discipline and much research needs to be done to realise its potential. New approaches being studied include therapeutic cloning of stem cells (a controversial therapy used to create specific cells); and pharmacogenetics (study of how drugs work in the body). There are numerous legal, ethical issues to be considered before any of these treatments are routinely offered.

For more information on genetics and cancer:

Cancer Council Australia
cancer.org.au/cancer-information/causes-and-prevention/family-history-and-cancer

Genetic tests and cancer (A podcast developed by Cancer Council NSW)
cancercouncil.com.au/podcasts/episode-9-genetic-tests-and-cancer/

What help is available in Western Australia?

Your general practitioner is a good place to start. They can refer you to a specialist service for testing and genetic counselling if appropriate.

Genetic Services of WA, Familial Cancer Program
A state-wide service providing counselling, diagnostic and laboratory services.
Phone **(08) 64581603**
ww2.health.wa.gov.au/Articles/F_I/Genetic-Services-of-WA

Familial Cancer Registry – offers assistance with surveillance follow-up. Phone **(08) 9340 1603**.

A full directory of genetic services in WA can be found at **Human Genetics Society of Australasia hgsa.org.au/asgc/western-australia.**