Submission to Senate Legal and Constitutional Affairs Committee inquiry regarding the Patent Amendment (Human Genes and Biological Materials) Bill 2010.

Clinical Associate Professor Judy Kirk

Director, Familial Cancer Service (FCS) at Westmead Hospital. This is a service that cares for families with a genetic predisposition to cancer (and in many families this involved testing certain genes); member of the cancer care team in the Western Sydney Local Health Network

I commend the Senate Committee for conducting this important inquiry. As a specialist in cancer genetics and director of one of Australia's largest familial cancer services, I feel the matter of gene patents must be clarified so that clinical care and research are not hampered by patents on the human DNA sequence.

Summary:

The previous Senate Inquiry's terms of reference provided an opportunity for independent cancer clinicians to emphasise the significant potential risk to patient outcomes associated with commercial monopolisation of genes and genetic technology. This submission relates to the same issues.

Research has resulted in an improved ability to detect people at high risk of cancer through analysis of their family history and genetic testing. Cancer genetic testing requires the knowledge and use of the human DNA sequence. Risk assessment and genetic testing are available through family cancer services throughout Australia. Advances in cancer screening, cancer surveillance and cancer prevention have also been made. It is important to identify individuals at high cancer risk so that these advances can be applied in their management with the aim being a reduction of cancer risk and cancer mortality. Equally important is the identification of those not at high risk, so that they are spared unnecessary cancer surveillance and concern. Limitations on the use of the human DNA sequence may hamper clinical service and stifle on-going research in this rapidly changing field. (A practical clinical example is used to explain the use of cancer genetic testing.)

Under current arrangements, genetic tests for familial cancers such as breast and ovarian cancer are freely available through a number of public hospital laboratories in Australia. Patenting genetic material could lead to commercial monopolies of cancer tests and increased costs. This has occurred overseas, when gene patents have been enforced.

Data exchange among professional peers, benchmarking and continuous improvement are fundamental to the optimal training and accreditation of healthcare professionals. Commercial monopolisation of genetic testing has the potential to compromise the longstanding ethos of health professional development.

While patenting was, as I understand it, introduced to encourage innovation, commercial monopolisation of biological material risks stifling competitive research.

As expressed throughout this submission, commercial monopolisation of genes and other biological material has the potential to impact negatively on health outcomes in Australia, by reducing access to diagnostic and therapeutic procedures, stifling research and development and reducing the effectiveness of professional training and development.

In my opinion, on the basis of my lay understanding of patent law and its evolution, human biological material should not be considered patentable subject matter. Its identification is a discovery, rather than an invention.

It is critical for policy makers to understand that genetic technology in relation to cancer prediction, diagnosis and treatment is in its infancy. As the technology develops, current patenting arrangements may become increasingly anachronistic and unwieldy, with problematic consequences for government, as well as the risk of inferior public health outcomes.

Gene patents and cancer: a clinician's perspective

Cancer is a genetic disease, associated with alterations (mutations) in genes that normally act to control cell growth, proliferation and DNA repair. These genetic mutations usually occur in somatic (tissue) cells over the course of a lifetime. However, some rare families have an inherited mutation in one of these same genes. People who inherit a mutation in a cancer-associated gene are at increased risk of developing cancer. The pattern of cancer seen in the family will depend on the specific gene involved and sometimes on the type and location of mutation in that gene.

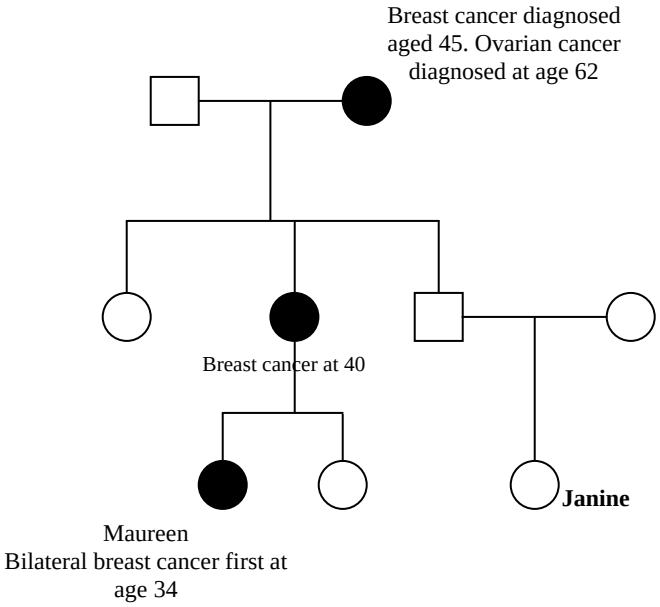
Genetic testing is now available through family cancer services for some of the common hereditary cancer syndromes. Whatever the gene(s) to be tested, the general principles remain the same. The first step in cancer genetic testing is usually to take blood from one of the family members affected by the condition. This must be done with fully-informed consent. Counselling before testing must cover the potential harms, benefits and limitations of such testing. The laboratory then searches the relevant gene(s) to determine whether a causative gene mutation can be found. This first phase, the "mutation search", may take some months in some centres. A causative gene mutation cannot be found in every family, as mutations may be missed, or mutations may be present in other genes that are not yet identified. Importantly, this means that if the family history is strong and the genetic test (mutation search) fails to identify a gene mutation in an affected family member (with a significant family history), that test result should be considered "inconclusive" and all relatives remain at potentially high risk. Further testing may be done in the future as technology improves or as further predisposing genes are found. However, if a causative mutation is identified in the relevant gene (eg. in BRCA1 or BRCA2 for a breast cancer family), then other at-risk family members (males and females) can be offered "predictive" genetic testing. Predictive tests are relatively cheap and quick, with results generally available in four to six weeks. Once the family gene mutation has been identified in the mutation search phase, using a predictive test, others in the family can simply be tested for the presence or absence of that same gene fault.

The risk of cancer associated with the gene mutation and the approach to that risk requires discussion before testing. Pre-natal testing and pre-implantation genetic diagnosis is feasible once the family mutation is identified, but is not often considered in cancer families. Importantly, those who are found not to carry the family mutation (at predictive testing) should be considered to be at average risk of cancer. They and their offspring can be spared unnecessary cancer screening and concern. Those identified to be at high risk can be offered appropriate cancer surveillance and effective cancer prevention. The following hypothetical family history of breast/ovarian cancer will be used to illustrate these points.

Hypothetical

JANINE (not her real name), 32, was concerned about what the family history of cancer might mean for her offspring. Janine's father had two sisters. One sister died of breast cancer at age 40. That sister has two daughters, and one of them (Maureen) was diagnosed with cancer in both breasts (bilateral breast cancer), first at age 34. Janine's father's mother was diagnosed with breast cancer at age 45 and then ovarian cancer at age 62. The family tree is shown in Figure 1.

Figure 1



In this example there is likely to be a dominantly inherited gene mutation that is associated with an increased risk of breast and ovarian cancer. The family history indicates a genetic susceptibility to breast and ovarian cancer that may be due to a germline mutation in *BRCA1* or *BRCA2* within the paternal side of the family. This family history put Janine and others at *potentially* high risk of breast and ovarian cancer, as individuals may or may not have inherited the mutation. The family hoped that genetic testing would clarify this further.

In 1997 a blood sample taken from cousin Maureen for a “mutation search” (at no cost to the patient) was sent to a public laboratory for testing. At that time no mutation could be found in BRCA1 or BRCA2 – the result was “inconclusive”. Even today, about 50% of such tests are inconclusive, but fortunately the samples were held in the testing lab with the consent of the patient, so that further testing could be done as technology (for testing BRCA1 and BRCA2) and/or knowledge (about other genes) improved. The family recontacted the service in 2008 to report further family history. Although Maureen had since died, her DNA sample was retested with new sequencing technology and a mutation in BRCA1 was finally identified. The family was notified that “predictive testing” was now available and since that time many family members have presented for testing. Some of them lived in other states, so a sample of Maureen’s DNA was sent to other labs to facilitate the testing of relatives. Eventually, Janine’s father was found *not* to carry the family mutation, meaning that Janine could not have inherited it, so Janine is now at average risk of cancer. Maureen’s sister (now 40) *was* found to carry the family BRCA1 mutation – she has had her ovaries and fallopian tubes removed (a procedure which not only dramatically reduces the risk of those cancers but also halves the risk of breast cancer). The family is greatly relieved that the cause of the problem has been identified and that measures can be taken to reduce cancer risk in those who *are* at genetic risk.

This scenario is a common one in family cancer clinics and applies also to families with a genetic predisposition to other cancers, e.g. bowel cancer. The identification of cancer susceptibility genes only occurred with research unfettered by patents on the human DNA sequence. The clinical testing of families commenced in Australia prior to any company having an exclusive licence to test the genes. The testing has been paid for by the public system at no cost to the families. Laboratories have kept the costs of testing to reasonable levels. Laboratories have stored samples, and retested stored samples. Laboratories have worked very closely with clinical services (and other labs) towards providing high quality care for cancer families, sharing samples and knowledge as progress occurred. Access to testing has been equitable. Research in this field

needs to continue – there are new genes to be discovered, gene-gene and gene-environment interactions to be understood with prevention and special therapies to be developed. Such advances will not occur if certain gene sequences are patented or monopolised.

Finally, on a more general level, the Senate inquiry needs to consider limiting patentable subject matter and licensing agreements. Although patents have already been granted on a large number of human genes, it could be argued that the identification of a gene sequence or the link between a genetic mutation and disease is a “discovery” rather than an “invention” and that the human gene sequence is not “novel”. Some of these patents have been granted after public funds contributed to the background research. It would be preferable to exclude genes and non-coding sequence from patentable subject matter. If patents *are* granted, licensing should be limited, non-exclusive and affordable. Genetic tests will be an increasingly integral component of health care in the future. It is important that individuals have equitable access to high quality, appropriate and affordable genetic testing.

Judy Kirk

12/1/2011