Gene packs

"No aspect of human existence will remain unaffected by discoveries in human genetics - irrespective of the new science's predictive accuracy or therapeutic efficacy. In their increasing claims on our attention and our resources, the new technologies will shape the way nearly everyone thinks." [1]

As an artist and individual I am interested in and concerned by particular issues raised by recent developments in the field of biotechnology. In this paper, I have written about some of my ideas and concerns with regards to recent developments in the field of genetic engineering and review how these ideas feed into my art practice.

My approach is to explore the scientific processes that are currently being utilised in the field of genetic engineering. As part of my research I have had my own chromosomes imaged. When I initially decided to go about this I approached professionals in Melbourne to request their assistance with my research. This raised moral and ethical issues for them arising from the fact that blood is required to produce a karyotype and they could not justify taking blood from a healthy person and then using their resources for artistic purposes. Their decision was also influenced by an absence of precedents of this nature at their laboratory. As an alternative they offered the use of existing images for my research.

I then undertook a short residency at SymbioticA (Art and Science Collaborative Research Laboratory) where they are actively involved and interested in creating awareness through artistic exploration of wet biological processes. As part of my artistic process it was important for me to experience the scientific procedures used to image chromosomes. The protocol used to image chromosomes takes time to develop and perfect; my attempts were not successful at this time.

In further pursuit, with assistance from SymbioticA, I then had my chromosomes imaged by an interested and willing medical doctor. To do this I was required to give blood, my cells were then cultured for about 72 hours, they were then treated with two particular drug types; one initially to make the cells divide more rapidly than they would naturally and then another to stop the cells from dividing. At this point the cells were gently exploded and my chromosomes were imaged using light microscopy. Through this experience I learnt a great deal about the scientific processes involved with imaging chromosomes. This was also the first time that I had experienced working in a scientific laboratory as an artist.

The body and the way in which we perceive it are central to our conception of the self. This conception is fluid and evolves with the integration of new ideas and perspectives. Developments in medical technology, such as the decoding of the human genome, have produced huge volumes of data from which we are developing a new understanding of ourselves. At this time, in many areas of our lives, huge importance is placed on our genetic material, we are lead to believe that our DNA contains the definitive instructions that makes us who and what we are.

I considered my own DNA contained within my chromosomes and I was overwhelmed with thoughts that here in front of my eyes was the genetic instructions containing the possibilities for my very being. However through further consideration I have become to understand that even though our physical and psychological make-up may be determined by genetic instructions the expression of our genes is profoundly influenced by our environment.

"There is probably not a single condition, physiological or pathological change that doesn't result in profound changes in cell or gene expression…immediately upon putting it in tissue culture and trying to grow it in tissue culture the gene expression pattern changes profoundly." [2]

I have since spent time at the Murdoch Childrens Research Institute in Melbourne where extensive genetic research is being undertaken. There I have been generously given the opportunity to engage in conversations with research scientists and to take photographs within the facility. Through my contact with scientists at the research institute I have become aware of research being done in developing artificial chromosomes to be used for gene therapies in the future.

"*…Whole manufactured chromosomes will be gently injected into embryonic nuclei. These artificial chromosomes will be constructed with components that ensure their faithful duplication and passage into the pair of cells that forms with every cell division in the developing embryo and fetus. A critical advantage of artificial chromosomes is that they provide a means of adding not just one gene to an embryo, but a 'gene-pack' containing hundreds, even thousands, of new genes with many different properties."* [3]

The procedure for altering the genetic make-up of an individual would require inserting an artificial chromosome into a patients body. Artificial chromosomes would be adapted from a patients chromosome. The chromosome would have been treated the following way: all the genetic information would be removed except for the centromere and specific selected genes would have been added. Gene therapies could cause unforseen problems; for example the intention may be only to change somatic cells, however if accidental changes occur in germ cells in reproductive organs then future generations may become affected as well. An important issue to address as a society is how we deal with the issue of altering the genetic make-up of embryos.

"…the effects of the implanted DNA would be wreaked on our descendants to the remotest time." [4]

The expression of specific genes varies from individual to individual. Researchers are trying to find the gene or genes that cause mania and depression, otherwise called Mood Genes, if found sufferers could be helped by dramatically improved treatments. There is strong evidence to suggest that the genes for depression and mania are hereditary. The expression of these genes vary between individuals, some who possess the genes that cause this condition may suffer from blinding mania however for others the condition may be quite mild. The latter individual may suffer from short bouts of depression followed by energetic times where creative, sexual and social energy is high. If the definitive gene or combinations of genes are discovered for mania and depression then gene therapy treatments could become problematic because it would be impossible to predict how the genes would be expressed in different individuals. If an embryo is diagnosed with the particular genes that cause depression or mania should the parents change the genetic make-up of their unborn child? Should we make decisions on behalf of undeveloped individuals?

"I have often asked myself whether, given the choice, I would choose to have manic-depressive illness. If lithium were not available to me, the answer would be a simple no - and it would be an answer laced with terror. But lithium does work for me, and therefore I suppose I can afford to pose the question. Strangely enough I think I would choose it.…Because I honestly believe that as a result of it I have felt things, more deeply; had more experiences, more intensely….And I think much of this is related to my illness – the intensity it gives to things and the perspective it forces on me…" [5]

My interest now lies in the discovery of 'mood genes', the development process of artificial chromosomes as a gene delivery method and the profound ethical issues raised by the implications of germ line therapies should they develop in the future.

gene discovery - body_manufacture™

I am part of an artist group called body___manufacture™ which was initiated in 2000 by Sylvia Kranawetvogl, Erik Hable, myself and later joined by James Cecil. Founded out of the idea to come together to explore and research biotechnology in response to recent developments. The individuals in the group felt compelled to consider consequences, possibilities and the affect these advances have on the present and will have on the future. They believe now to be an important time to address the issues that arise from the discoveries in genetics. The aim was to exhibit research material and art works in an exhibition titled *gene discovery* in 2002.

For *gene discovery* the group collaborated on an inflated architectural structure which was based on the current representation of the chromosome form. We chose a chromosome form as this is a genetic structure that most people could recognise, using this as an entry point into the subject matter being addressed. The audience could enter the chromosome and in doing so they transformed their immediate environment.

Each of the artists also contributed different aspects to the exhibition. James Cecil created a sound work; this was placed inside and attached onto the chromosome structure via speakers and wires. James used the sounds of the body as well as medical processes and equipment to listen to the human body in hyper-detail to create an impression of 'micro listening'. Still within the structure, an animation by Erik Hable titled *NX-tools* could be interacted with, proposing fictitious prototypes for highly advanced genetic engineering tools. The *NX-tools* were modelled on electron microscopy images of molecular structures of the human body giving the viewer the sensation of being in a world within a world within a world. Sylvia Kranawetvogl contributed computer-generated digital prints which combined fashion photography with images from highly advanced biotech imagery. Sylvia is interested in how genetic products will change advertising and the market place in the future.

My contribution included a video projection work created from the raw material of my Karyotype. I re-interpreted visual material (ordinarily used for diagnostic purposes) created from my body. Gene patenting was an issue I considered during the process of working with my Karyotype. Throughout the world biotech companies are competing to patent genes. I, symbolically, reclaimed my own genetic material.

"It's likely that within less than ten years, all one hundred thousand or so genes that comprise the genetic legacy of our species will be patented, making them the exclusive intellectual property of global pharmaceutical, chemical, agribusiness, and biotech companies." [6]

For *gene discovery* I photographed vessels containing human tissue cultures taken inside a tissue culture laboratory and used for genetic research purposes. I produced images of light microscopy photographs of my own dividing cells to show what tissue cultures actually look like. For research purposes genetic departments purchase bodily materials such as tissue cultures and proteins obtained from specific genes. Ethical issues are raised as to where this material originates from and if the donor gave permission for their bodily material to be used for research purposes. It is astounding that as individuals we don't actually own our own bodily material. This fact was established formally in 1990 when the California Supreme Court made a ruling that an individual has no property right over their body tissue.

When considering the work of the other artists in body__manufacture™ Erik Hable's work is of particular interest to me. In developing his fictitious *NX tools* Erik drew from scientific theories and engaged in advanced genetic engineering research to consider issues that may arise as genetic technologies develop in the future. As well as exploring issues raised by genetic technologies Erik is interested in the mechanisms at work in developing and producing products for release onto western markets. *Bio-tool* is based on cells that exist in the human body called macrophages. Macrophages freely wander the body patrolling and cleaning up cellular debris, engulfing and ingesting micro-organisms, other cells and foreign matter including bacteria. *Bio-tool* would be inserted into an individuals body (already containing a copy of their DNA) where it would travel around the body to check for unwanted alterations and weaknesses. If changes were detected the *Bio-tool* would manufacture a new copy of DNA and insert this into the affected cell but only working on somatic cells. *Bio-tool* would exist in the body as an independent organism where it would regulate and replicate itself depending upon the needs of the body. *Bio-tool* would constantly regulate all the cells in the body replacing mutated DNA and maintaining the body in an immortal state. The release of *Bio-tool* on to the market will be in suspension until the human genome project is finished and the function of every single gene and their relationship to each other is known.

"The new genetics has already opened a vast arena for contests of power over what it means to be human, who has the power to define what is normal, who has access to what resources and when. Who will control the knowledge of our bodies after the human genome project has been mapped and sequenced all human genes? How can we ensure that this will not be another project for enforcing narrow norms of 'human nature' as Donna Haraway has put it, for legislating 'genetic destiny?'. How can we respect the diversity and difference that the Human Genome Project also establishes as 'normal'?" [7]

Nano-mech is another fictitious product proposed to monitor the development of an embryo by detecting and fixing abnormalities in the genetic make-up during pregnancy. *Nano-mech* would ensure that all babies born would be 'normal'. Currently certain illnesses and conditions can be detected in an unborn fetus, these genetic conditions have profound affects on the developing individual. In the future how far will western medicine go in deciding what is normal and how much variation will be allowed to exist between individuals? *Nano-mech* is the silent worker inside the mothers body, pre-programmed as a surveillance instrument monitoring the development of the future of the human race.

The four artists of body__manufacture™ have richly different approaches to their work and ideas which are inspired by the issues that move them as human beings. It is fascinating to consider how each of the individuals has manifested their ideas.

Public opinion and support for developments in the field of genetic engineering is influenced by many sources including the market place, committees of experts, medicine, sociology, theology, the media and artists. It is very important for all sorts of people to be aware of and involved in the issues raised by genetic engineering because it raises so many ethical questions that the law, science and medicine can not fully answer.

"In democratic countries…public opinion may be the final arbiter for accepting the new eugenic techniques."[8]

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