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AFRICA
HUMAN GENOME
INITIATIVE

LEXICONS&LABYRINTHS

Iconography of the genome

Foreword

Modern human beings among all species have developed a capacity for aesthetic expression which, like linguistic abililty, marks our uniqueness. The material that make these abilities possible lie somewhere on the map produced by the human genome sequencing project, but we do not know where and in what proportion or how to make sense of it once we know.

As with everything else in life, our biological capacities are just that, and the challenge is what to make of them and therefore how to push ourselves to the best of what we are capable of.

We therefore put to the artists whose works feature in this catalogue the challenge to engage at an earlier than a later stage, with the findings of modern biology and genetic science, and to represent and interpret as only they know best what they might add to the wonders of the human imagination.

Their answer is before you, and they invite us to engage those other amazing human abilities, our visual acuity and our brain's ability to turn sight into metaphor, concept and idea back on life, enriching our existence beyond mere survival, pushing us to greater achievement.

Wilmot James
Executive Director:
Social Cohesion and Integration Research Programme
Human Sciences Research Council

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Iconography of the Genome: Analogy and Representation

Fritha Langerman, Michaelis School of Fine Art, University of Cape Town

To make a model is to give shape to or find visual form for a theory, and it is this search for appropriate form that gives rise to visual and linguistic analogy. It is significant that at this fifty-year anniversary of the first full model of DNA by Watson and Crick, this exhibition attempts to explore some of the complex representational issues surrounding the human genome. Current times are thought to be pre-eminently visual[1] and it is in an age obsessed by the optical that the Human Genome Project (HGP) emerges – a project that is ultimately concerned with the relationship between the 'text' of the body and the 'images' that this text produces.

At the outset, it is necessary to contextualise current imaging of the scientific body with a historical overview. Visualisation of the biomedical body is a will to understand its internal mechanisms and a will to find visual analogy to describe the unseen. It looks for equivalents in order to explain what cannot be efficiently described in words. This is evident throughout medical history, but has its most significant precursor in the Enlightenment that was a period obsessed with visual mechanisms that sought to make the invisible visible by revealing the internal through dissection and magnification. The development of machinery during the 18th and 19th centuries provided metaphors by which to visualise the body system, and many of these still endure. In order to understand function, the body was reduced to small units, named and reassembled: the body became secularised by the scientific gaze, transforming it into a divisible machine.[2] Similarly today the brain is likened to a computer, a cathedral or a Swiss army knife, and the heart to a pump etc.

Anatomisation is inextricably linked to visualisation. Leonardo da Vinci is considered by many to be the founder of modern anatomy and Albrecht Dürer's book on human proportion became a fundamental resource for medical illustrators during the 16th and 17th centuries. Andreas Vesalius was the first anatomist to apply scientific method to his study, and publish his illustrations and writings in *De fabrica*, the definitive 16th century medical text that was copied and disseminated throughout Europe. In 1628, William Harvey published *De motu cordis*, in which he relied heavily on illustration to articulate his research into the mechanisms of the human heart. The most enduring anatomical publication of the 19th century was *Gray's Anatomy* (1858), from which many illustrations are still reprinted. The development of lithography in this period allowed for a wider distribution of illustrations, while the use of photography improved accuracy. Wax models were also a popular form of anatomical demonstration. Illustration became the explication of the body, and by implication it was the image that became the medical text.

Contemporary medical imaging non-invasively, electronically dissects the body, producing diagnostic images. Ultrasound uses high frequency sound waves to calculate tissue depths and produce analogous images. Thermography makes use of heat imaging to detect infection, while CAT scanning calculates the absorption of x-ray beams by the body at various points, and uses this information to create an image. MRI scans provide cross-sectional images of the brain at different points. These imagings probe the body, exposing the private, internal space and providing access to the real rather than generic body. Heidegger gives primacy to the operation of technics in the production of scientific knowledge. Science is only made visible through instrumentation and secondary technologies, and only through these means can a relationship to the natural world be established. Technology is its visual-isation – its becoming as an image.[3]

The Visible Human Project, begun in 1993, created a virtual body from that of Joseph Paul Jernigan, and introduced a corporeal transparency by digitally rendering sections of the body. This became seen as the new anatomy – a transformation of the body into anatomical 'text'.[4] The Visible Human Project is closely linked to the HGP in terms of its will to provide science with a visual representation of the body

that is expressed as data, and is concerned with the production of a reproducible prototype body. This perpetuates the assumption that biomedical illustration seeks to represent a generic body – an average type. In so doing it introduces the notion of normative anatomy and some of the ethical concerns around the HGP.

In medical illustration the body is a given form and there is an understood relationship between form, mechanism and function, whereas at a genetic level the complexity is harder to visualise. Although the mechanisms of DNA and genetic code are known entities, an effective means of visualising this is still lacking.

The technologies and freedoms allowed by the HGP and VHP have forged a new kind of collaboration between art and science. Three recent examples are the current *Bodyworlds* exhibition, curated by pathologist Gunther von Hagens,[5] where interior bodies are plastinated and presented on public exhibition; Self, by Marc Quinn (1991), a self-portrait cast in six pints of blood; and the work of Eduardo Kac,[6] whose transgenic projects manipulate and transform living organisms. All of these examples are concerned with substance and the body as spectacle. The former two examples are not unlike the wax anatomies of the 1800s and the extraordinary collections of Frederik Ruysch who injected balsamic fluid into organs and used them to construct landscape tableaux in the 1700s. Kac's work, however, reflects the anxiety of the post human[7] state where emphasis has moved from the somatic as a significant reality to data as location of a state of being. The reduction of the body to a series of code or data means that it can be integrated into other data systems, economic, political or biological. The human body is no longer a fixed entity but limitless. Ironically the HGP simultaneously regulates what it means to be human in terms of difference, setting the limits of humanity.

Analogy is a system that seeks similarity through difference and is a means of visualising the unseen or indescribable. In this way descriptions of the genome are most commonly linked to time and space: 'the human genome if written would fill 150 phone books of 1 000 pages (this figure varies) or a 61m stack of paperbacks; there are 3 billion letters of code in every cell; 12 000 letters are decoded by the Human Genome Project every second; to recite one letter per second for 24 hours would take a century', and so on. The computer is often used as an analogy: sequencing is a digital script; it has memory and RAM (binary, octal with 256 states) and is likened to RNA (3 base codon, quaternary with 64 states).[8] In contrast to medical illustration where the politicisation of the body is more apparent,[9] the iconography of the genome is more neutral as the anonymity of the diagrammatic provides a seemingly dispassionate distance. Common visual representations include the double helix (in linear and model form), series of code, the stripes of the autoradiogram.[10] The popularisations of these representations serve to domesticate the genome, without necessarily providing useful insight into its implications.

The two most persistent analogies applied to the HGP are those of the map and the book. The plotting and reading of the body suggest the title of this exhibition: *Lexicons and Labyrinths*. This refers to systems and complexities, order and chaos, the specific and the infinite, to reading and to mapping, to time and to place.

Mapping most easily describes the aims of the HGP as it refers to places and loci that offer specific information. However, it is perhaps an unfortunate analogy as it recapitulates many of the fears around the motives of the HGP. The legitimacy of a map relies on the absence of the author in that it is believed to represent a real rather than a perceived world, and an artificial objectivity is transposed on the map in order to distance it from its author. Many early anatomists saw the body as unfamiliar territory, which could be tamed and understood by detailed recording. The body-map provided access to the unseen internal body, and thereby had to power to

control it. A map provides an index by which to determine power and exercise control: it refers to ownership. It actualises the division of territory, which is part of the colonial legacy that saw a world of empty space to be possessed and exploited.[11] This is particularly pertinent in light of what has become commonly termed 'bio-colonialism' and is of special significance to Africa.

The Cartesian definition of the body is that of one which occupies space, whereas the digital archive and genetic map exists over time. The HGP is also referred to as an archive, a museum, and a search for traces. It is a continuum, an intertextual, multi-referential entity and a historical narrative. In this way, the body is simultaneously spatial and temporal.

Perhaps one of the most interesting analogies is that of text and the semiotic relationship between the genetic code and its expression as image – how the body is signed by its text.[12] In the interests of extending this analogy I have made a comparison to the lexicon – a system of reference, or a dictionary containing encyclopaedic information that can be applied consistently. It is also a system that identifies words by their difference and is concerned with their origin, meaning and expression. All of these have obvious parallels in the HGP, which identifies sequences of code (or words) that have a direct correspondence to physical traits. In both cases there is an active system of reference between word and meaning. A word is defined as a sequence of letters bound on either side by a blank space – similar to the three-letter codon. However, contrary to the development of language where the relationship between form and meaning have become irrelevant in the shift from the pictographic to ideogramatic to symbolic, the relationship between genetic code and its meaning are neither formal nor symbolic but chemical. AGCT[13] as an image has become synonymous with genetic code, yet is shorthand for a sequence of nucleic acids that bear no physical relationship to their ultimate physical reference. There is randomness between form and ontology.

There are further comparisons that can be made between language and genetic code. Morphemes are the basic building blocks of words that cannot be further reduced. These may be added to prefixes and suffixes, inflections, tenses or compounds to mutate and shift the meanings of words and their context-bound interpretation. This is similar to the shifts in meaning based on the sequence of nucleic acids. Collocations are words that co-occur within short distances of one another and have expected and recognisable relationships to one another, whereas denotata is a linguistic form associated with concept or a mental representation of a phenomenon in the real world.[14] Not all words are concepts (words like 'if' and 'but') and bear some relationship to 'junk' DNA in that although it is recognised that they may have a significant role, their direct reference is as yet undetermined. Semantic play (that two meanings may be denoted by a single word and that two words may have the same meaning) is echoed by the genotype and phenotype.[15] The physical manifestation of the code may differ and as such, genes are conceptually present, yet physically absent.

Linguistics and the science and understanding of language are bound up with the genetic code and reading of human body – the body as a text, which evokes the notion of authorship. Early western medical science considered the body as a text and God as the author – divine intention was revealed by probing this text. Post-Darwinian medicine deposed God in favour of science, determining medical theory as author of the body. The HGP replaces the biblical text 'in the beginning was the word' with 'in the beginning was the code.' Authorship in this context does not reside necessarily with science as decoder, but with the body itself. In this light, the concept of origin emerges and in an area where everything is about transcription and reproduction of codes, in what body this resides.

Analogy and representation are ideologically driven and, at the same time, the primary means through which visual knowledge is communicated. They are ultimately scripted by particular paradigms and demonstrate a perspective that shifts with time and context. It is important to recognise that science and its interpretation are never free from the socio-historical environment in which they are constructed, and that meaning is not intrinsic, but produced. Visualisation occupies a central role in the formation of public perception as it has persuasive power and is able to shift understanding of what is 'natural'.[16] Thus meaning is never fixed, but can be reattributed.

Artists in this exhibition have investigated the iconography of the genome through ancestral, socio-historical, formal, philosophical and economic means. In order to make visual that which cannot be articulated verbally, it is the method of art to work with suggestion, analogy and reference. It is not yet known what the implications of the Human Genome Project may be, and as such, its iconography has not yet been claimed. Its visualisation is not bound by science, but is a territory with mutable meaning, open to varied modes of representation.

1 Barbara Stafford contrasts this to a 'logocentricism' or dominance that the written word has had over the visual in communication. Stafford B (1996) *Good looking: essays on the virtue of images*: p39. Cambridge, Massachusetts: Harvard University Press.

2 This is contrary to current Complexity theory that looks at the entire, interrelated organism. It considers the whole cell, rather than reductionist genomics that looks at the DNA alone.

3 Waldby C (2000) *The Visible Human Project: Informatic bodies and posthuman medicine*. New York: Routledge.

4 Waldby C (2000) *The Visible Human Project: Informatic bodies and posthuman medicine*.

5 The anatomical exhibition of real human bodies includes an exhibit of individual organs as well as whole bodies and cross sections. In November, von Hagens performed the first public autopsy in 170 years.

6 *The Eighth Day* brings together living transgenic life forms and a biological robot (biobot) in an environment enclosed under a plexiglass dome, thus making visible what it would be like if these creatures did in fact co-exist with us in the world at large. All of the transgenic creatures in *The Eighth Day* are created through the cloning of a gene that codes for the production of green fluorescent protein (GFP). As a result, all creatures express the gene through bioluminescence visible with the naked eye.

7 This term has arisen out of new technologies that have mediated previous constructions of self and what it means to occupy a body. Plastic surgery, genetic therapy and computer implants are examples that have increased a fragmented and artificial notion of 'human'.

8 Mendelow B *Problem based learning for medical students: the importance of the molecular anchor*. Conference paper for The Origins of Humanity and the Diffusions of Populations in Africa Conference, Stellenbosch, 2002.

9 Much anatomical representation portrayed the female body as other – outside of the norm. The symbolic division of anatomy into the feminine nervous system and masculine musculature further reinforced stereotypes.

10 Autoradiography is a technique for producing a visual image of the distribution of DNA fragments. Strands are labels with radioactive markers and recorded onto x-ray film. The result is a series of bands. Kevles DJ & Hood L (eds) (1992) *The code of codes: scientific and social issues in the Human Genome Project:* p376. Cambridge, Massachusetts: Harvard University Press.

11 Wood D (1992) *The Power of Maps*. London: Routledge.

12 Founded by Saussure, this is a discipline that investigates the nature of signs and the laws governing them.

13 Base pairs: alenine, guanine, cytosine, thymine.

14 Singleton D (2000) *Language and the lexicon*. London: Arnold.

15 Genotype is the total inherited genetic constitution of an individual, whereas the phenotype is the physical appearance of an organism.

16 The physiognomic maps of Lavater (1790s) convincingly argued that character was determined by physiology.

Engaging with science

Anusuya Chinsamy-Turan, Zoology Dept, University of Cape Town

Science has given us a better understanding of who we are and of our place in the universe: we know that we live on the third planet of our sun, on the outskirts of a spiral galaxy that is one of millions of galaxies of a possibly infinite universe that began about 15 billion years ago. From fossilised remains of organisms entombed in rocks we have learnt that the earliest life forms evolved about 3.2 billion years ago, whereas our human ancestors evolved only about 3.5 million years ago. Palaeoanthropologists have shown that our ancestors begun using stone tools about 2.5 million years ago and fire was harnessed about 2 million years ago. From these early beginnings, humans have consistently added to this knowledge. Today we have the technology to launch a rocket into space, to land a vehicle on Mars, and to take astoundingly beautiful pictures of distant galaxies without even being there. At a more practical, everyday level, science has changed the way we live – electricity, telephones, cell phones, clean water on tap, cars, buses, trains, medicines, etc., are all products of science. Relatively young fields such as biotechnology and bioinformatics have made major scientific strides, and it appears that in the near future we can look towards genetically-based medicinal products to eradicate diseases such as malaria, tuberculosis, and perhaps even HIV/AIDS.

Science touches almost every aspect of our lives. Yet, many people are 'afraid' of science and feel that science is not something they can do. These negative perceptions can be blamed perhaps on the way in which science is portrayed. To the average person a scientist is an eccentric male who wears a white labcoat and spend hours in a laboratory concocting chemicals of some sort or another. Very few people think of women as scientists or think about the fact that there are many scientists actively involved in research to improve the quality of our lives. This negative stereotype of what scientists are and what it is that scientists do needs to be actively negated.

One of the desperate realities we face in South Africa is a shortage of scientists and engineers. This is largely an historical problem, since the majority of black people were denied an education in science because of the previous government's apartheid policies, and many women for several different reasons tended not to seek careers in science. Considering that it is well recognised that the socioeconomic development of a country is directly correlated with technological development, it is imperative that we think creatively of innovative ways to stimulate interest in careers in science and engineering. As a result, science communicators often direct their efforts to children to expose and alert them to careers in science. However, it needs to be recognised that because of the legacy of apartheid in South Africa a large percentage of the adult population have not had any science education. As such there is a general lack of understanding of basic principles of science. Thus, science communicators need to devise strategies that target both children and adults. It is not that we expect everyone to become scientists, but rather that through improved communication of science people would be empowered to understand how scientific knowledge is generated and applied, and how it impacts on their daily lives. Increasingly, our society is moving in a direction where ordinary people on the street need to make decisions that involve an understanding of science – for example, should they eat genetically modified foods? Should their children drink milk from hormonally treated cows? How would health care change with increasing use of biotechnology? If people understand science better then they would be empowered to make informed decisions that affect their lives.

The challenge now is how to communicate about science more effectively and to encourage more public engagement with issues around science? There are many ways in which one can attempt to do this. I believe that museums are wonderful spaces to do just this. Here people can experience the world of science without restrictions of a curriculum or boundaries of a classroom. Natural history museums in many places around the world showcase the world of science, and often open minds to this exciting world. New ways of exhibiting collections have shown a coming together of art, culture and science, and have revealed the inter-relatedness of these fields. For example, the recent exhibit *Go Bats!* at the South African Museum dealt with various aspects of the biology of bats, but also highlighted cultural aspects of how bats featured in folklore, and mythology, as well as showcased beautiful art inspired by bats. *The Birds of a Feather* exhibit at the National Art Gallery had a similar approach – it dealt with wonderful art inspired by birds, as well as with biological or scientific aspects of birds, such as extinct birds like the Dodo and *Archaeopteryx*. Besides exhibitions, scientists at both museums and universities need to engage more with the public regarding their research. Networks between journalists and scientists need to be established so that effective science journalism can be developed. If new developments in science were reported in an accessible manner, the public would realise how scientific knowledge develops and grows continuously.

A huge problem that science communicators often face is that we end up talking to the converted, i.e. to people already interested in science. There is a dire need to devise creative ways to reach new audiences – particularly audiences that would not usually be interested in science. To this end, innovative ways of using plays, puppet shows, radio and art are currently underway. The collection of art inspired by the Human Genome Project is one such example of a fresh approach that merges cutting edge science with art and helps develop a new audience. Throughout the ages, artists have been inspired by the beauty of the natural world and in the actual anatomy of animals and plants. The human genome art exhibit goes a long way to facilitate and improve dialogue in science.

Willem Boshoff

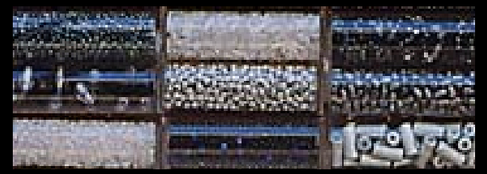
(little) matter
(big) time
(small) chance

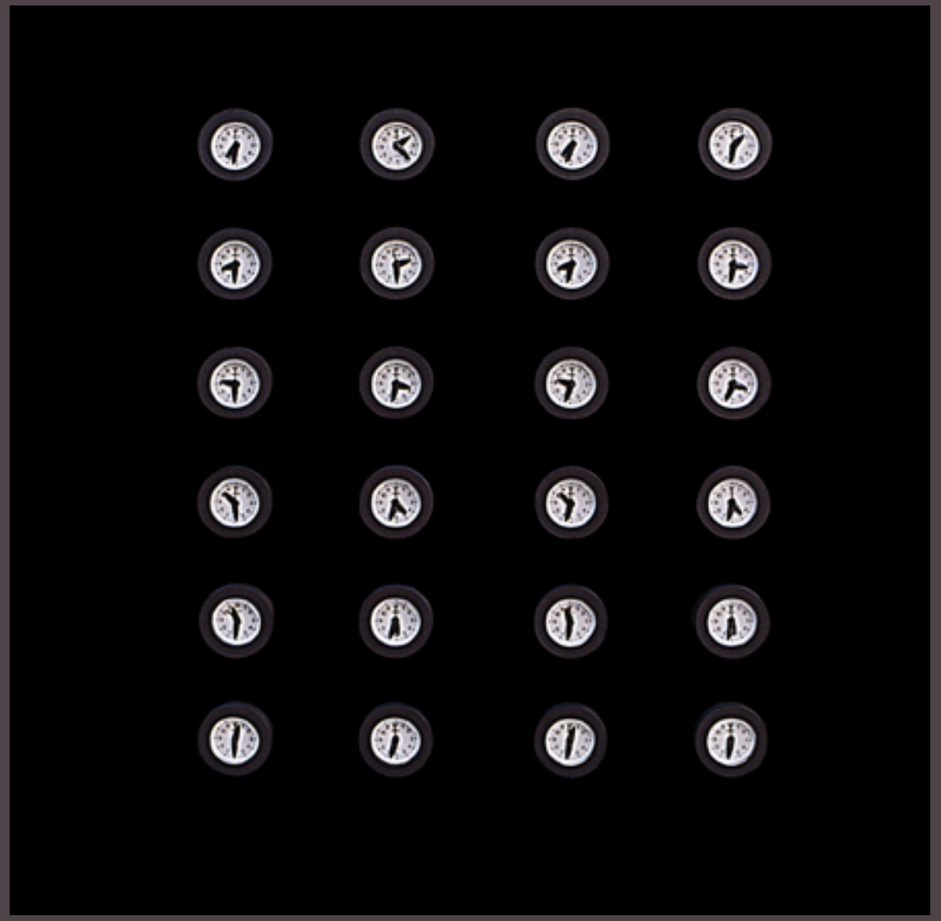
This references three constants in evolutionary theory: the co-existence of matter, time and chance. Existence itself is random and statistically, highly unlikely. The genome is a small detail in a vast evolutionary history.

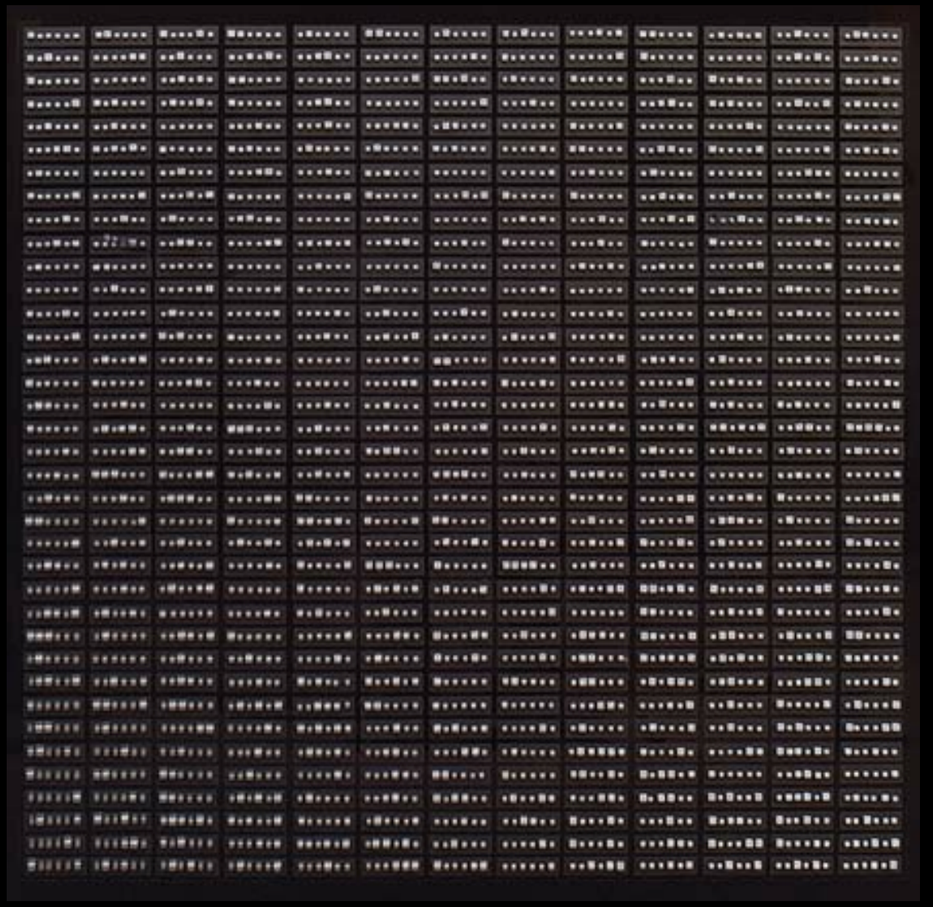
(little) matter
507 glass vials are filled with beads and other precious objects. Beads evoke the molecule, treasure chest, and the wondrous as well as referring to Africa. The final effect is reminiscent of the stripes of autoradiograms – bands of inheritance and of matter as evidence.

(big) time
Twenty four clocks are each set at hourly intervals.

(small) chance
481 units of six dice each are laid out in a grid. They evoke writing – a text – a genetic script and a code.







Brother' s Keeper

The father of eugenics, Francis Galton, was in many ways the opposite of his first cousin, Charles Darwin. Where Darwin was methodical, patient, shy and conventional, Galton was an intellectual dilettante, a psychosexual mess and showman. He was also brilliant. He explored southern Africa, studied twins, collected statistics and dreamed of Utopias.

For weeks there were twins. They sat in the back of a Yellow Arrow bus; disappeared on a television screen; hovered at the edge of Matt Ridley's *Genome: the autobiography of a species*. They remain between memory (chromosome 16) and death (chromosome 17) as case studies H.M and N.A and a confirmation that the 'genome knew when to delegate.'

Enter the Pied Piper of Hamelin whom i follow up the road to the Animal Unit at UCT's Medical School and into a contained habitat the size of a human shoebox.

In the course of the last hundred years, at the same time as the human race moved into cities, the Norwegian rat became a permanent resident of scientific laboratories. It has been transformed by careful breeding over three hundred generations into a more docile, less fearful creature, and this has been achieved even though almost its only function now is to suffer stress, run through mazes, press buttons to avoid electric shocks, and have bits of its body amputated.

The chapters slowly fall into place. Miserable white mice, unlying blood, bean sprouts.

What did the poet say to the pathologist?

Is history the same as yesterday? Is environment home?

That is what we all thought. We had reckoned without naked mole rats. Naked mole rats are a species of hairless, nearly blind little rodents that live in large underground colonies in dry areas of Kenya, Somalia, and Ethiopia. They appear to be truly 'social insects' of the mammal world.

Trees, leaves, giraffes, antelopes, lichens, fish and algae. Buildings, vases, cave paintings, Christmas carols, stone axes, bridges, steamships, telephones, street lamps, uncollected teeth.

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Woolfson A (2000) *Life Without Genes*. London: Harper Collins.

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Mr Noel Markgraaff of the Animal Unit, Medical School, UCT, kindly arranged for the loan of 23 animal units.


S1


ABO

Model-making

- 1953: Watson and Crick unveil the first model for DNA: four base pairs twisted into a double helix.
- 2003: an eight-metre long model is constructed from pharmaceutical packaging in the South African Museum. It consists of four different transparent units that are repeated in a sequence. The ribbed fluorescent strip echoes the leviathan below, speaking of scale and origins.

Inventory:

350 medicinal spoons

50 10ml vials

80 dropper bottles

10 test tubes

320 needle covers

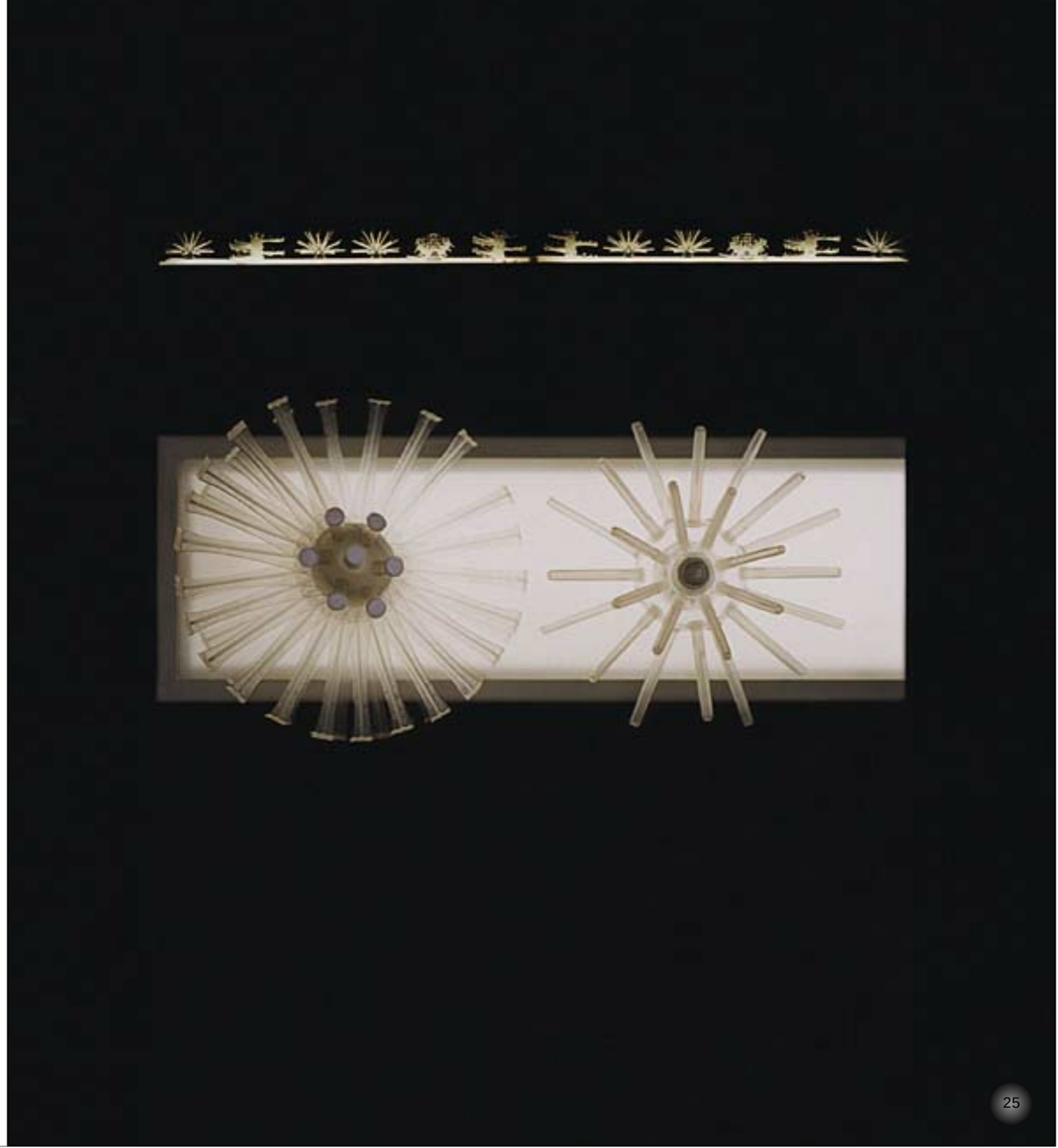
200 pregnancy test straws

22 glasses

20 plastic dishes

10 blister packs

100 aspirin



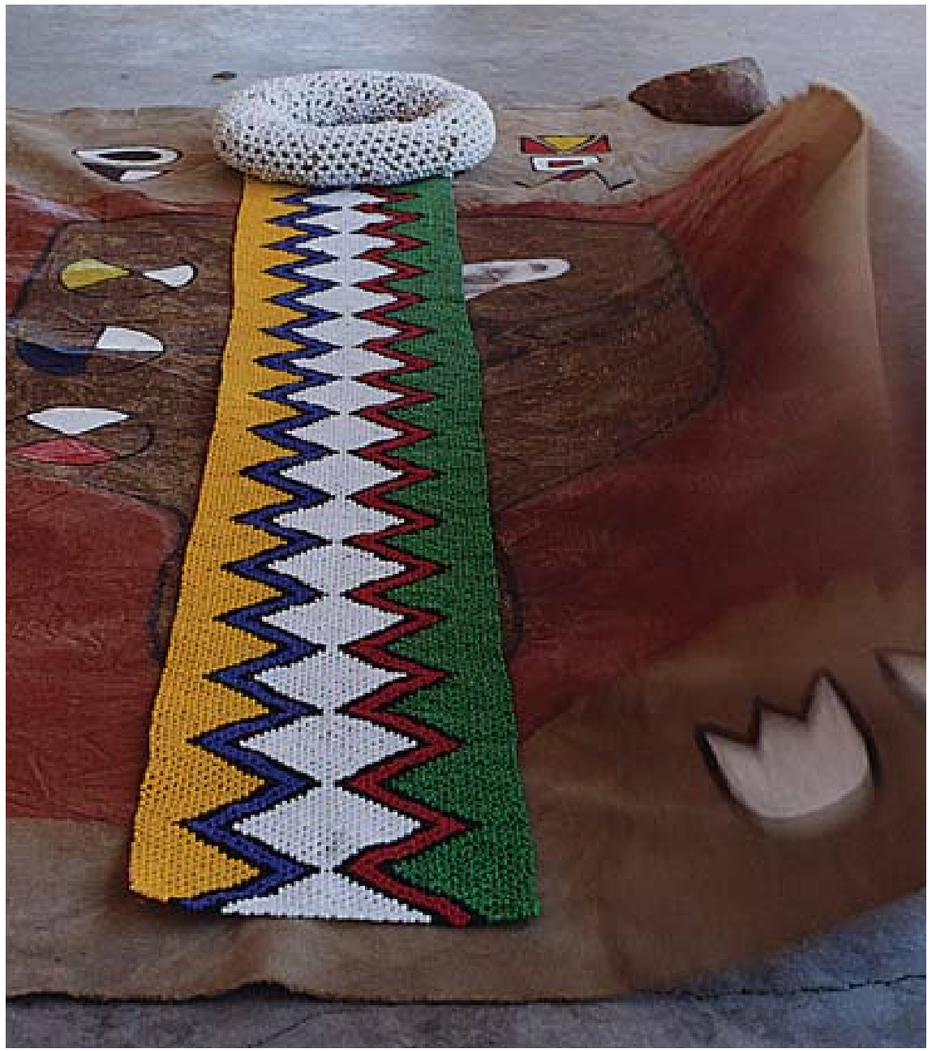
Isaac Nkosinathi Khanyile

So I am

Connections of sanguinity have, over time, formed a complex web of connections between families. What has for generations been understood as a connection through blood is now more subtly described through genetic inheritance. Connected chains are a manifestation of a long lineage of ancestry and blood relations.

So, I am is a work that confirms a physical and spiritual connection between all beings. It recognises that through celebration of life through its form, colour and symbolism there arises a mutual respect and harmonious co-existence.

Minute molecular structures – the cornerstones of life – that result in complex life forms, are echoed by the use of beads in the work. Simple units are woven to construct intricate objects or matter. Through this device I seek for answers about my origins, language, race, identity, and religion.



Malcolm Payne

28 February 2003

Dear Malcolm

Herewith a summary of the results we have obtained from both mtDNA and Y chromosome analysis of your DNA:

Overall summary

MtDNA: haplogroup H (assigned to this group since the sequence differed from the published reference sequence, which is defined as haplogroup H, at only one position, a T to C mutation at position 16356. The published reference sequence has a T at this position – your sequence has a C at this position).

Y chromosome DNA : haplogroup R-M207 (also described as haplogroup IX-M207 using the Underhill nomenclature or Eu18 using the Semino system).

EXPLANA TION OF METHODOLOGY AND RESUL TS

Collection of sample and DNA extraction

I confirm that I collected a sample with your informed consent and that you signed an INFORMED CONSENT FORM indicating that you requested the testing on 10 December 2002. Your sample has since been worked on using a laboratory code.

Since the first sample, obtained using the cheek swab method did not give us good quality DNA and a poor yield, we asked you for a blood sample. A blood sample was drawn from you by Dr Jacquie Greenberg (Department of Human Genetics, UCT Medical School). Dr Greenberg's laboratory also undertook to extract the DNA and the DNA sample only reached me on 27 February 2003.

Essentially, during the extraction process, the white blood cells are lysed using a combination of detergents and buffers to release the DNA into solution. The DNA is then purified chemically and then dissolved in a buffer. This DNA contains both nuclear DNA that contains chromosomal DNA and mtDNA from the mitochondria, the latter being located in the cytoplasm of cells.

MtDNA analysis

We target the mtDNA control region for sequencing. This is a section of the mitochondrial genome (total length about 16 500 base pairs) that is about 1 200 base pairs long and does not code for any genes. We use this region for population and evolutionary studies since this region of the molecule is not (to the best of our knowledge) under the influence of selective forces and mutations occur purely by chance. Other regions of the mtDNA genome are coding and involved in a biochemical process that is responsible for the production of energy in the cell in the form of ATP. Mutations in these regions are often deleterious and sometimes lead to disease. By focussing on two regions in the control region where most of the variation occurs, and referred to as hypervariable regions (HVR) I and II, it is possible to derive a mtDNA type from a sample. The mutations (changes) are described relative to a published reference sequence.

Most laboratories these days make use of variation only in the HVR I making use of about 400 bases within the control region. We used both hypervariable regions (HVR I and HVR II) in this analysis.

The control region of the mtDNA molecule was amplified using a method known as the polymerase chain reaction (PCR) to make many copies of the target region to facilitate further analysis by sequencing. A typical PCR reaction consists of about 30 cycles during which the target region is amplified exponentially. After this step, the product is purified and then sequenced in an automated DNA sequencer. Once the sequencing run is completed, the sequence is compared with the published reference sequence to determine which sites differ from the latter. We then use the positions were mutations are detected to derive a mtDNA type (or lineage).

Your sample differed from the published reference sequence at position 16356 (TÆC) within HVR I and was identical to the published reference sequence using HVR II data. According to the internationally adopted nomenclature of mtDNA types, this sequence would be assigned to haplogroup H. A haplogroup is a group of mtDNA types that are closely related due to the presence of a common mutation among them. Brian Sykes's laboratory at Oxford introduced names to personalise the mtDNA types found among people of European origin and referred to these seven common haplogroups (U, X, H, V, T, K and J) as the 'Seven daughters of Eve' (see slide 1).

These seven 'women', have been given the names Ursula (Latin for 'she-bear'), Xenia (Greek for 'hospitable'), Helena (Greek for 'light'), Velda (Scandinavian for 'ruler'), Tara (Gaelic for 'rock'), Katrine (Greek for 'pure') and Jasmine (Persian for 'flower').

Conclusion : Your mtDNA profile is consistent with a European origin. 'Helena's descendants are the most numerous in Europe having started 20,000 years ago from a hunting family in the Dordogne region of southwest France. After the ice Age her clan moved north reaching Britain about 12,000 years ago' (source – website above).

Y chromosome DNA analysis

The Y chromosome is located in the nucleus of the cell. There are over 300 mutations that have been described. Using the frequencies and distribution of these mutations one finds a very good concordance between haplogroups (group of different haplotypes) and geographic origin.

Using a hierarchical approach to guide our typing, we resolved your Y chromosome to haplogroup IX (using the nomenclature introduced by Underhill et al. 2001), also referred to as haplogroup R (according to the Y chromosome consortium) or Eu18 (according to the nomenclature adopted by Semino et al 2000).

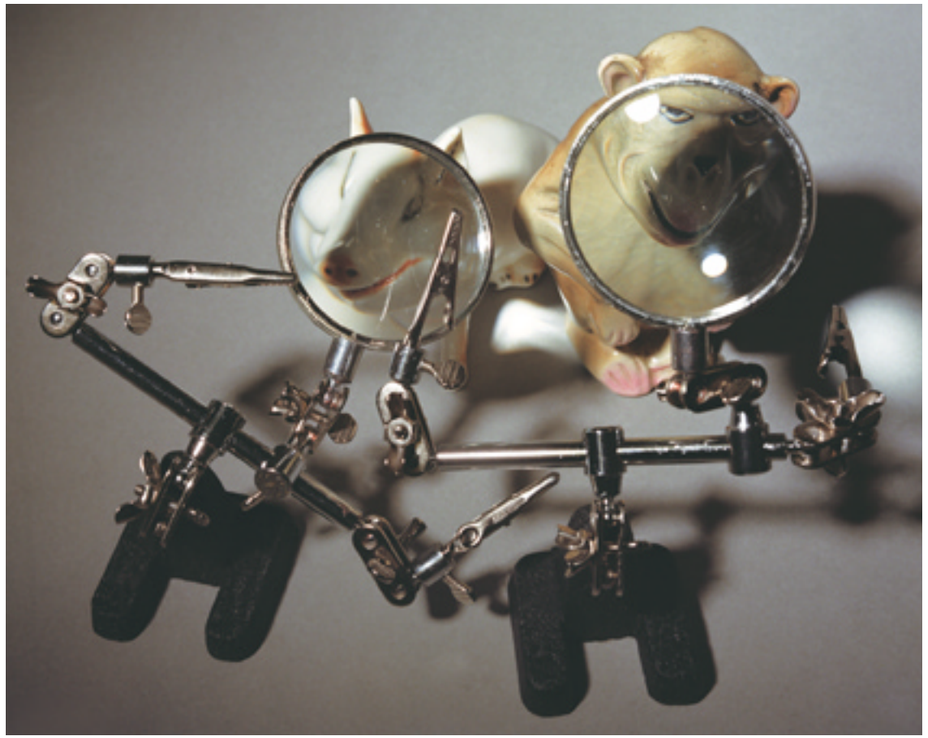
Haplogroup R is defined by marker M207. This is a dominant lineage in western European populations and is thought to be a signature of an expansion that originated from the Iberian Peninsula after the Last Ice Age (about 13,000 yeas ago; Semino et al. 2000). This haplogroup has a frequency of about 72% in British, 70.4% in Dutch, 50% in Germans; 52.2% in French.

Hope this information helps you in understanding your ancestry better, and when used in conjunction with your genealogical information, affords you the opportunity to deal with the question(s) of identity that you raised in a previous email to me.

Do not hesitate to call or email me should you need further explanation of the results.

Yours sincerely,

Dr Himla Soodyall (PhD)
Director: MRC/NHLS/Wits Human Genomic Diversity and Disease Research Unit

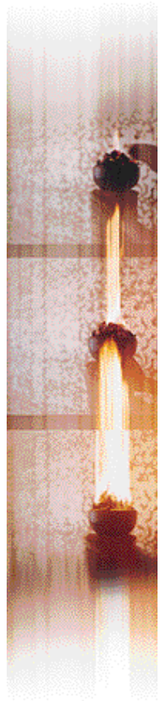


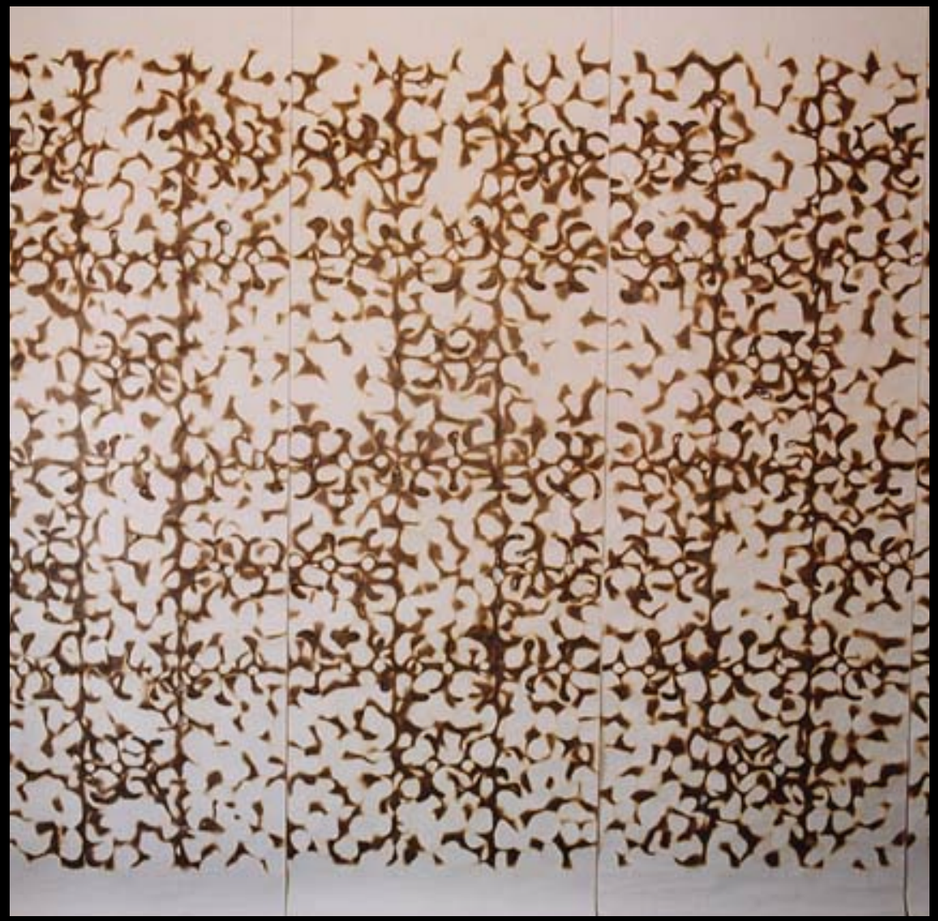
Acknowledgements. Magnifying grippers: Rose Shakinofsky

Sandile Zulu

I see genetics as an entry point to a study of human behaviour. I am concerned with how the genotype and inheritance may influence the development of a mentality, and how this in turn influences the phenotype – the physical body. The work is thematically concerned with the iconography of the genome in terms of its psychosocial implications rather than as illustration. The piece is a study of convoluted forms, reminiscent of the brain and is a metaphor for the mind as the seat of awareness and complexity. It is a fire-painting on wallpaper, produced by employing elemental and immaterial processes (fire, water, air and earth). It is a process – an experiment that parallels the constant quest to discover the meaning of existence and the essence of being human.

The work is comprised of six parts and measures 1 600mm x 3 000mm.





Nadja Daehnke

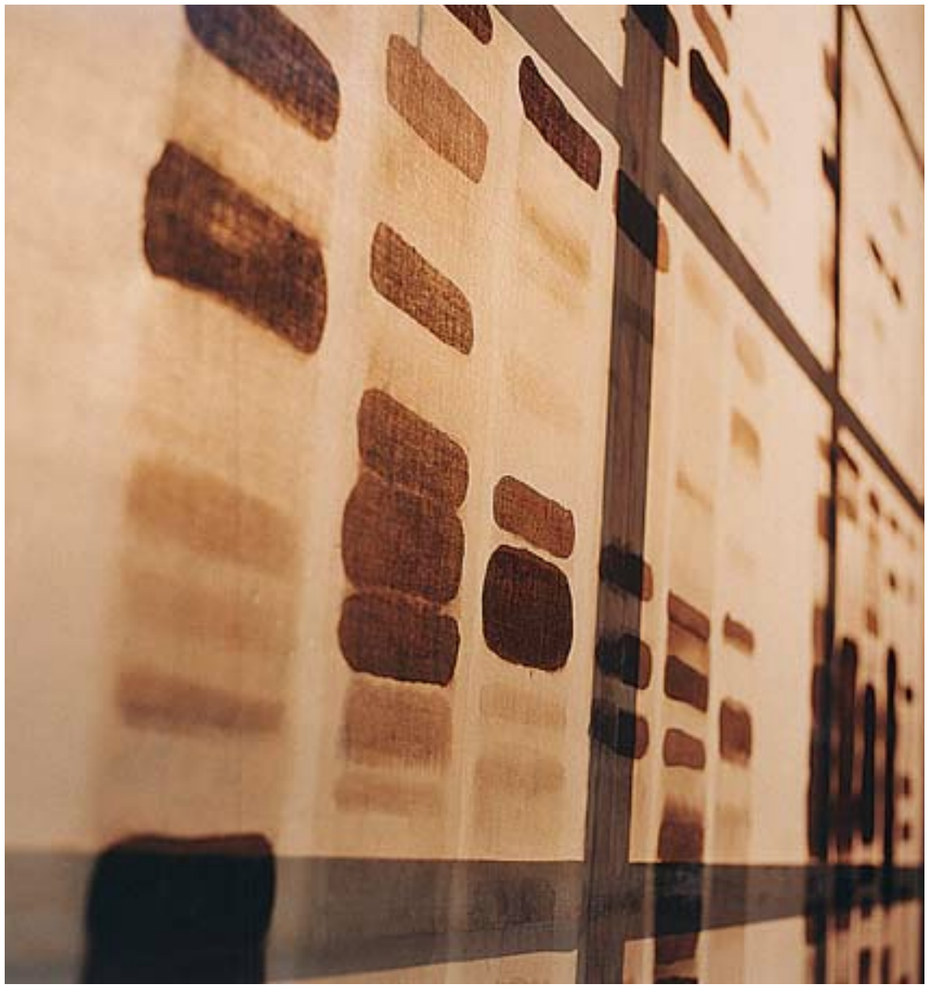
imaging human/imagining human

The history of medical, social and anthropological science is full of examples of theories and knowledge-systems which, despite their prominence and importance during their heydays, have been called into question subsequently. Criticisms of these sciences focus particularly on the political and economic motives which underlay the construction of these medical or anthropological theories. Thus theories of eugenics, degenerationism, racism and sexism have been criticised as being constructed in order to lend scientific support to ideological agendas.

Images and texts used in the installation were sourced from textbooks of such now outmoded and disreputed theories. Thus one diagram, for instance, divides humanity into distinct categories and assigns a particular moral and intellectual worth to each of the categories. Not suprisingly, this division mirrors the then contemporary belief in the superiority of Caucasian races. Such theories at the time formed a legitimising backdrop to colonialist and imperialist exploits.

Numerous writers and scientists have celebrated genetics as making possible a new paradigm for understanding humanity. Genetics is understood as furnishing ultimate proof against ideologically motivated historical scientific theories.

However, the interconnection between knowledge and power is unavoidable and the possible relation of contemporary genetic sciences to ideology cannot be ignored. The history of science should thus form a cautionary note about the uses knowledge is put to. Thus many current controversies and debates center around the possibility of genetics being used to legitimise a newfound biological determinism.



Biographies

Alan Albor ough was born in 1964 in Durban. He has a BA Fine Art degree from the University of the Witwatersrand and an MA Fine Art degree from Goldsmiths College, University of London. He currently lives in Stellenbosch and is a Senior Lecturer in the Department of Fine Art at the University of Stellenbosch. His work is seemingly concerned with systems and modular forms made from compatible readymade objects and devices. He received the FNB Vita award in 2002 and the Standard Bank Young Artist Award in 2000. He has exhibited at several other exhibitions, including US Art Gallery, Stellenbosch 2000, *Graft* 2nd Johannesburg Biennale 1997.

Willem Boshoff was born in 1951 in Vereeniging and studied at the Technikon Witwatersrand, South Africa. He lives and works in Johannesburg. His main references are dictionaries; botanical gardens; medieval, early and avant-garde music. His use of language systems often subverts the traditional gallery practice to the advantage of disadvantaged social groups or ecological issues. He has exhibited at numerous biennales, including São Paulo, Stuttgart, Johannesburg, Havana and Venice. Exhibitions include *The Short Century*: *Independence and Liberation Movements in Africa*, Villa Stuck, Munich, Germany, and *Authentic/Ex-centric: Africa in and Out Africa* curated by Olu Oguibe and Salah Hassan for the Venice Biennale.

Lien Botha was born in 1961 in Pretoria. She obtained a BA at Pretoria University and worked as a press photographer for Beeld in 1983. She received a BA Fine Art from the Michaelis School of Fine Art, University of Cape Town, in 1988 and has since become increasingly involved in fine art production. She has had numerous international and national exhibitions, including *Krotoa's Room*, Castle, Cape Town 1995, *Fault Lines: Inquiries into Truth and Reconciliation*, Castle, Cape Town 1996, and was the 1997 Standard Bank Young Artist winner. She has also curated many exhibitions and is the subject of a recent monograph in the Taxi series. Her work is largely photographic and installation-based and is concerned with layering of history.

Nadja Daehnke was born in Johannesburg in 1971 and currently lives in Cape Town. She obtained both BA and MA degrees with distinction at the Michaelis School of Fine Art, University of Cape Town. She teaches part-time at the Cape Technikon and at the University of Cape Town. Her most recent solo exhibition, *Borderlines*, was shown at the Goodman Gallery, Johannesburg. Her group exhibitions include *Theory and Myth: interpretations of time and space in the visual arts*, and *Weatherreport*, South African National Gallery 2000, *Holland South Africa Line*, Bagagehal, Amsterdam 2000, and the *District Six Sculpture Festival*, Cape Town 1997.

Isaac Nkosinathi Khanyile lives in Umlazi, Durban. He received a BTech Degree in Fine Art at Technikon Natal, where he is currently teaching and finishing his Masters degree. In 2000 he received the 'Our Heritage Image' Award (Fine Art and Culture Development Co-operative), KwaZulu-Natal. In 1999 he was a nominee for the FNB Vita Award and was the winner of the Commonwealth Art and Craft Award. He won the Volkskas Atelier Award in 1996. Exhibitions include *Sands to Stones*, Midland TAFE, Western Australia 2000, *Dreams and Visions*, Fremantle, Western Australia 1999, *Amasiko Ma-Afrika Amasiko*, Civic Gallery, Johannesburg 1998 and *Holland South Africa Line*, Den Haag, Amsterdam and Cape Town 2000. He comes from a long line of diviners and many of his works are inspired by dreams.

Fritha Langerman was born in Cape Town in 1970. She studied at the Michaelis School of Fine Art (MFA), University of Cape Town, where she is currently a senior lecturer. She was a merit winner at the ABSA Atelier in 1999 and in 2002 was awarded the Third Cape Town Public Sculpture commission. Recent international group exhibitions include *CON/TEXT* and *I.D./OLOGY*, Axis Gallery, New York, 2002 and *International Print Exhibition*, Macau Museum of Art, 2000. Solo exhibitions include *Black Boxes* 2002, CODE 1998 and *The Dissection* 1996. Her projects have been concerned with the ordering, collecting and display of information – cultural, medical and scientific.

Malcolm Payne was born in 1946 in Pretoria and currently lives in Cape Town, where he is a Professor of Fine Art at the Michaelis School of Fine Art, University of Cape Town. He studied at St Martins' School of Art, London, and has an MA in Fine Art from UCT. He was winner of the 1984 Standard Bank Young Artist Award. Solo exhibitions include *Untitled* USA, *Untitled* Holland, *Untitled* UK, 46th Venice Biennale 1995. His current work is video-based and recent exhibitions include *South African artists on the Worldwide New ideas Ñ old tricks*, hARTware projekte Dortmund 2001, *Videobrasil*, Video Festival Internacional de Arte Electronica, Sao Paolo 2001, *World Wide Video Festival*, Arti et Amicitiae, Amsterdam 2001 and *Global Conceptualism: Points of Origin 1950s–1980s*, Queens Museum, New York.

Sandile Zulu was born in 1960 in Ixopo, Kwazulu-Natal. He was nominated for the FNB Vita Art Award and has exhibited widely. Solo exhibitions include *Atomic Project 1*: Sandton Civic Gallery, Johannesburg 1997, *Atomic Project 2*, Zola Gallery, France 1997, *Fire!* Rembrandt van Rijn Art Gallery, Johannesburg. Group exhibitions include *New art from South Africa*, Talbot Rice Gallery, The University of Edinburgh, Scotland 1997, *Graft* 2nd Johannesburg Biennale, 1997. Sandile Zulu works with materials in his immediate environment and juxtaposes the debris of industrial culture with natural objects and forces.