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2014

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Available at: https://works.bepress.com/andra-leroux-kemp/19/

DOI: http://dx.doi.org/10.5235/17579961.6.1.109 (2014) 6(1) LIT 109–128

The Potential Role of Behavioural Genetics in South Africa's 'Fight against Crime'

Andra le Roux-Kemp*

> Lurking in the shadows is the pervasive fear that genetic differences undermine the foundations of democracy. This confusion comes from thinking that to say that everyone is created equal is the same as saying that people do not differ genetically … The essence of democracy is that all people should have legal equality despite their genetic differences. It is not the case that we are all identical genetically except for a few rogue genes that make some of us different. There are millions of DNA sequences that differ in our species; genetic variation is the fundamental natural resource of our species. Recognition of, and respect for, individual differences is essential to the ethic of individual worth.[1]

1. INTRODUCTION

The persistent high level of crime, and especially violent crime in South Africa, is one of the major challenges of this relatively young democracy. Although the most recent crime statistics released by the South African Police Service show that the incidence of violent crimes has decreased substantially over the past six years,[2] the statistics also confirm that South Africa's crime rate remains one of the highest in the world.[3] The continued, concerted and collective efforts of the South African government, NGOs and other stakeholders in fighting crime and corruption are certainly laudable (generally referred to as the *Fight Against Crime*). And recently the Minister of Justice and Constitutional Development, Jeff Radebe, once more pledged the government's continued commitment to securing a safer environment for its citizens. Minister Radebe specifically highlighted

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1 Robert Plomin, John C DeFries, and Gerald E McClearn, *Behavioural Genetics* (Worth, 2008) 269.

2 For example, the murder rate in South Africa decreased by almost 17% from April/March 2004/2005 compared to April/March 2011/2012, and the total number of reported cases of sexual offences by almost 7% over the same period. (The incidence of reported rape cases also decreased for the first time in 2011/2012 by 1.9%.) See South African Police Service: Crime Research and Statistics (September 2012), www.saps.gov.za/statistics/reports/crimestats/2012/categories.htm.

3 See www.unodc.org/unodc/en/data-and-analysis/homicide.html.

the importance of an increased focus on rehabilitation programmes in South African correctional facilities, as well as the modernisation of the systems of the South African Police Service—including the regulation of forensic evidence and the establishment of a Forensic DNA Intelligence Database for South Africa.[4]

It is against the backdrop of these recent and ongoing developments in the South African Criminal Justice System that this article will consider the potential role that behavioural genetics can play in South Africa's *Fight Against Crime*. While much has been written about the potential role and value of the application of behavioural genetics at the various stages of a criminal proceeding,[5] this paper will—for practical reasons—be limited to the potential role that behavioural genetics can play in the sentencing stage of criminal proceedings in South Africa. The discussion will furthermore be limited to offenders' propensity for criminal behaviour,[6] and the window of opportunity that two legislative reforms in South Africa have created for the application of behavioural genetics in criminal matters.

First, an introduction and general overview of South Africa's minimum sentencing legislation and Forensic Procedures Act 37 of 2013 will be presented. The purpose of this overview will be to provide a specific context and area of application for behavioural genetics in criminal matters—a topic that has been discussed at great length and by many scholars. It will be shown, for example, that in terms of these legislative reforms, the time may be ripe in South Africa to discuss and consider how an objective and interdisciplinary perspective of crime and criminality, which includes behavioural genetic research, can serve in the *Fight Against Crime*. This will be followed by a succinct overview and summary of the fundamental scientific principles relating to Forensic DNA Phenotyping, specifically behavioural genetics, and the application thereof to criminal matters.[7] The paper will conclude with a discussion of the potential role that behavioural genetics can play in the sentencing phase of criminal proceedings in South Africa, as well as in the rehabilitation programmes available to offenders in correctional facilities.

2. RECENT DEVELOPMENTS IN THE SOUTH AFRICAN CRIMINAL JUSTICE SYSTEM

In this section, the effects of South Africa's minimum sentencing legislation—including overcrowding in prisons, poor rehabilitation of offenders and a high rate of recidivism—

4 Justice, Crime Prevention, Safety and Security Cluster (JCPS) Post-State of the Nation Address media briefing by Minister of Justice and Constitutional Development Jeff Radebe, 24 February 2013, www.info.gov.za/speech/DynamicAction?pageid=461&sid=34427&tid=99366.

5 See eg David Wasserman and Robert Wachbroit, *Genetics and Criminal Behaviour* (Cambridge University Press, 2001).

6 Not diseases.

7 For a comprehensive analysis and discussion of DNA typing and the use of forensic DNA evidence, see John M Butler, *Forensic DNA Typing* (Elsevier Academic Press, 2nd edn 2005).

will be highlighted. This is important for this discussion as it will be shown in sections 4.1 and 4.2 of this paper that the application of behavioural genetics in the sentencing phase of criminal proceedings, as well as with regard to rehabilitation programmes in the case of custodial sentences, may be worthwhile to consider in South Africa. Section 2.2 gives a brief introduction to the current and ongoing process of establishing a Forensic DNA Intelligence Database in South Africa and bringing our legislation with regard to the collection, storage and use of forensic evidence (specifically DNA evidence) 'up to date' and in line with international standards and practices. It will be shown that the provisions of the recently promulgated Criminal Law (Forensic Procedures) Amendment Act 37 of 2013 can (albeit theoretically at this stage) accommodate Forensic DNA Phenotyping at post-conviction stage, and can (with further regulation and due regard to all the human rights concerns already raised with regard to the provisions of the Act) allow for the limited application of behavioural genetics evidence in the sentencing phase of South African criminal proceedings.

2.1 Minimum Sentencing Legislation and the Importance of Rehabilitation Programmes in South African Correctional Facilities

In 1997, Criminal Law Amendment Act 105 of 1997 was passed in reaction to a public outcry for harsher sentences for convicted offenders, and in an attempt to send a clear message to offenders that 'crime does not pay'.[8] This followed after the 1996 crime statistics released by the South African Police Service confirmed South Africa as the most violent country in the world excluding war zones.[9]

The Act (generally referred to as the minimum sentence legislation) is still in effect today, even though it was brought in as a temporary measure because of 'the perception that crime was getting out of hand and the belief that the remedy lay in harsh sentencing'.[10] The Act provides for minimum sentences to be passed for certain serious offences, specifically murder, rape and certain crimes accompanied by aggravating circumstances.[11] It also directs sentencing courts not to deviate from the prescribed minimum sentences unless substantial and compelling circumstances exist that warrant a lesser sentence in a particular case.[12]

8 The Act came into operation on 1 May 1998. Jan Smit, 'Community Corrections as an Alternative to Imprisonment in South Africa' (2004) 17 *Acta Criminologica* 55, 55.

9 www.sahistory.org.za/dated-event/crime-statistics-released.

10 The Act was initially intended to 'cease to have effect' on 30 April 2000. Hannes Fagan, 'Laws on Minimum Sentencing and Parole Spell Worsening Prison Conditions: Curb the Vengeance' (2004) 10 *SA Crime Quarterly* 1, 4; Stephan Terblanche, 'Mandatory and Minimum Sentences: Considering s 51 of the Criminal Law Amendment Act 1997: Sentencing' [2003] *Acta Juridica* 194.

11 s 51(1) and (2) Criminal Law Amendment Act 105 of 1997; Terblanche (n 10) 199.

12 A term of not less than 15 years' imprisonment is, for example, prescribed for an offender convicted for the first time of murder or rape and a term of 10 years for second offenders etc: s 51(1), (2) and (3) Criminal Law Amendment Act 105 of 1997.

Whether the harsher sentencing regime imposed by means of this legislation was effective and contributed to the substantial decrease in the violent crime rate in South Africa is open to debate.[13] What is certain, however, is that the imposition of minimum sentencing legislation in South Africa contributed to the rise of other problems in South African Correctional Facilities.

The net effect of this legislation was that convicted offenders now received longer prison sentences, which also contributed to the problem of overcrowding in South African prisons. Smit reported that the number of prisoners serving sentences of more than 20 years increased from 1,885 in January 1995 to 7,887 in January 2003. And those serving sentences of 10 to 15 years rose from 6,168 to 18,956 over the same period.[14] By 2004, the accommodation capacity of prisons in South Africa was exceeded by 68%, and in 2009 by 139.9%.[15] Today, South Africa is ranked ninth in the world in terms of prison population, with approximately 160,000 inmates.[16] It is generally accepted that such overcrowding 'precludes rehabilitation and turns prisons instead into places where criminality is nurtured'.[17] Extremely long sentences also make it difficult, if not impossible, for offenders to integrate back into society, and may therefore account for the high recidivism rate, estimated at 94% in 2002.[18]

2.2 Regulating DNA Evidence and Establishing a Forensic DNA Intelligence Database in South Africa

The public acceptance of DNA technologies in criminal matters continues to grow. But, while the use of DNA-based evidence has gained an unprecedented degree of trust over the past two decades, it has also given rise to a strong sense of fear.[19] The heated debate and delayed process of establishing a DNA Intelligence Database in South Africa is a case in point.

In February 2009 the Department of Justice and Constitutional Development introduced the Criminal Law (Forensic Procedures) Amendment Bill (B1-2008)[20] in Parliament, with a view to 'updating' the provisions of the Criminal Procedure Act 51 of 1977 and making provision for the collection, storage and use of fingerprints, DNA

13 The debate on whether harsher sentences do in fact serve as an effective crime deterrent does not fall within the ambit of this paper. See Fagan (n 10) 4; Julia Sloth-Nielsen, 'Mandatory and Minimum Sentences in South Africa: Assessing the Impact' (2005) 14 *SA Crime Quarterly* 15.

14 Smit (n 8) 56.

15 *Ibid*, 55.

16 www.news24.com/SouthAfrica/News/Govt-addressing-overcrowding-in-prisons-20130120.

17 Fagan (n 10) 4; Sloth-Nielsen (n 13) 18.

18 Unfortunately there is no reliable information available on the recidivism rate in recent years. See Smit (n 8) 56; Fagan (n 10) 4; Sloth-Nielsen (n 13) 18.

19 Antonio Amorim, 'Opening the DNA Black Box: Demythologizing Forensic Genetics' (2012) 31 *New Genetics and Society* 259.

20 Government Gazette 31759 notice 1584 (29 December 2008).

evidence and other biometric evidence in line with international guidelines and developments. However, due to a number of constitutional and human rights concerns that were raised, the relevant parliamentary portfolio committee decided, on 4 November 2009, to split the Bill and continue with the enactment of the fingerprint and other biometric evidence amendments,[21] but refer the DNA provisions back to the Minister of Justice and Constitutional Development.[22]

Some of the objections and concerns that were raised included arguments that the wide range of individuals from whom DNA samples could be collected and stored constituted an arbitrary invasion of privacy.[23] It was also argued that the storage of DNA samples (and to a lesser extent DNA profiles) constituted an infringement of the right to privacy,[24] and doubts were furthermore raised about the ability of the South African Police Service (SAPS) to take on the responsibility of managing and housing the DNA intelligence database, especially in light of the high levels of corruption that are allegedly also prevalent in the SAPS itself.[25] It was evident from the debate that raged in the media and in Parliament that politicians, members of parliament and the general public were hesitant to accept the potential advantages that these developments in forensic science had to offer,[26] despite the country's notoriously high crime rates and the urgent need for action. This could arguably be ascribed to South Africa's political past and its particularly sensitive stance towards the potential for human rights violations. Moreover, such hesitation is reinforced by the growing awareness that any given DNA sequence can provide private and sensitive information—on familial relations, physical characteristics, genetic mutations, ethnic markers, diseases and behavioural predispositions of a particular person as well as his/her relatives—that can lead to discrimination and stigmatisation.[27]

Yet, after wide consultation—including a study tour by the Parliamentary Portfolio Committee on Police Matters to Canada and the UK—a reworked Criminal Law (Forensic Procedures) Amendment Act 37 of 2013 was signed into law on 27 January 2014.[28] Although the primary aim of this Act is to establish a Forensic DNA Intelligence

21 The provisions pertaining to fingerprint evidence and the establishment of a fingerprint database were included in the Criminal Law (Forensic Procedures) Amendment Bill (B2B-2009) and were enacted as the Criminal Law (Forensic Procedures) Amendment Act 6 of 2010.

22 Lirieka Meintjes-Van der Walt, 'A South African Intelligence DNA Database: Panacea or Panopticon?' (2011) 27 *South African Journal on Human Rights* 496.

23 *Ibid*, 509.

24 In *S and Marper v United Kingdom* [2008] ECHR 1581; Application nos 30562/04 and 30566/04 it was held that the indefinite retention of DNA samples and profiles constituted a breach of the right to privacy.

25 Meintjes-Van der Walt (n 22) 510; South African Police Services Act 68 of 1995, s 15O.

26 The advantages of a DNA Intelligence Database in investigating and prosecuting criminal matters are numerous and well established. See the explanatory memorandum of the Criminal Law (Forensic Procedures Amendment Bill (B1-2008) Government Gazette 31759 notice 1584 (29 December 2008) for an exposition of the envisaged advantages that such a database will have for South Africa.

27 Meintjes-Van der Walt (n 22) 507.

28 http://us-cdn.creamermedia.co.za/assets/articles/attachments/47792_37268_act37of2013crimlawamend27jan2014.pdf.

Database in South Africa, and to provide for and regulate the collection, storage and use of DNA samples and profiles,[29] it may also sensitise the judiciary and the South African public to the potentially important role of forensic science, including the application of behavioural genetics, in criminal matters.

For example, the Act makes provision for the taking of bodily (DNA) samples[30] from a wide range of persons, including any person arrested for any offence.[31] These DNA samples may (in addition to the DNA profiles that are stored on the database) be retained for up to three months after the forensic DNA profile has been obtained and loaded onto the database.[32] Furthermore, the sample may be used (*inter alia*) for purposes related to the conducting of a prosecution.[33] It is therefore possible (albeit theoretically at this stage) to use these DNA samples[34] of convicted offenders to determine their propensity to exhibit anti-social behaviour[35] by means of Forensic DNA Phenotyping in conjunction with principles of behavioural genetics.[36]

The application of behavioural genetics in this instance, and the use of Forensic DNA Phenotyping technology on such post-conviction DNA samples, would not raise the same constitutional and human rights concerns that were raised with regard to the establishment of the Forensic DNA Intelligence Database in South Africa. In fact, it will be argued below that the innovative application of new scientific developments, and specifically behavioural genetics in the post-conviction phase of criminal proceedings, would serve both the interests of society and that of the offender.

29 A DNA sample is biological evidence obtained from a buccal swap, blood sample etc, from which DNA profiles are extracted. It is the DNA profiles that are eventually stored on the Forensic DNA Intelligence Database.

30 Intimate and non-intimate samples as defined in cl 1 of the Act amending s 36A Criminal Procedure Act 51 of 1977.

31 Clause 2 of the Act inserting s 36D(2)(a) into Criminal Procedure Act 51 of 1977.

32 Clause 2 of the Act inserting s 36D(6)(b) and clause 6 inserting Chapter 5B and specifically sections 15P and 15Q into South African Police Service Act 68 of 1995.

33 Clause 2 of the Act inserting s 36D(6)(a)(iii) into Criminal Procedure Act 51 of 1977.

34 Reference is specifically made to DNA samples here and not DNA profiles, as DNA profiles, which are stored on Forensic DNA databases, do not contain or reveal any personal information about a person. However, it must also be noted that some scientists have suggested that such so-called non-coding DNA may in fact contain much more information than previously thought. See Meintjes-Van der Walt (n 22) 497; Marcelo D Vinces, Matthieu Legendre, Marina Caldara, Masaki Hagihara and Kevin J Verstrepen, 'Unstable Tandem Repeats in Promoters Confer Transcriptional Evolvability' (2009) 324(5931) *Science* 1213; *S v Marper v United Kingdom* (n 24) paras 71 and 77.

35 Antisocial behaviour for the purposes of this discussion refers to the violation of rules and social norms, including forms of aggression, violent and criminal behaviour; see Laura A Baker, Serena Bezdijan and Adrian Raine, 'Behavioural Genetics: The Science of Antisocial Behaviour' (2006) 69 *Law and Contemporary Problems* 7, 14.

36 See David H Kaye, 'Behavioural Genetics Research and Criminal DNA Databases' (2006) 69 *Law and Contemporary Problems* 259.

3. FORENSIC DNA PHENOTYPING

Forensic DNA Phenotyping analyses the coding regions of a DNA sequence in order to compose a description of an unknown suspect.[37] The term 'phenotype' refers to a particular personal or physical distinguishing characteristic and includes a person's external and behavioural features, his/her geographical origin, and even a possible surname.[38] Already in 2006, Koops and Schellekens predicted that correlations between genes (genotypes) and phenotypes of both external and internal bodily characteristics and propensities for certain types of behaviour would be revealed within the next decade.[39] Their prediction was indeed correct and today, over 1,000 genes have been associated with inheritable human diseases, genes that encode visible traits such as hair, eye and skin colour are being identified, and genetic information has been used to provide information about a person's gender, age, ancestry, and even information about their relatives.[40]

Most countries have laws in place to govern DNA analysis of non-coding regions and the use of DNA databases; however, they remain quiet about the use of coding DNA in forensic investigations.[41] It is said that in these countries, common practice or doctrine restricts DNA forensics to non-coding DNA.[42] A limited number of jurisdictions explicitly legislate against the use of coding DNA and DNA analysis that may provide phenotypical information,[43] and in even fewer countries indirect forensic DNA pheno-

37 Bert-Jaap Koops and Maurice Schellekens, 'Forensic DNA Phenotyping: Regulatory Issues' (2008) IX *Columbia Science and Technology Law Review* 158.

38 Lirieka Meintjes-van der Walt, *DNA in the Courtroom: Principles and Practice* (Juta, 2010) 6; Pilar N Ossorio, 'About Face: Forensic Genetic Testing for Race and Visible Traits' (2006) 34 *Journal of Law, Medicine and Ethics* 277.

39 Koops and Schellekens (n 37) 159.

40 Ossorio (n 38) 278. It must also be noted that other technologies (other than DNA) have also been used to study the correlation between an aspect of a person's physical and biological make-up and their personality traits. For example, the pattern of dermal ridges on fingers (fingerprints) is largely genetically determined and researchers have shown that a correlation exists between these dermal ridges and a person's gender and sexuality. It has been suggested, for example, that while most people have more ridges on their right hand than on their left hand, women and homosexual men generally have a greater chance of falling into the latter category. Koops and Schellekens (n 37) 159. See JAY Hall and Doreen Kimura, 'Dematoglyphic Assymetry and Sexual Orientation in Men' (1994) 108 *Behavioural Neuroscience* 1203; Doreen Kimura, 'Body Asymmetry and Intellectual Pattern' (1994) 17 *Personality and Individual Differences* 53; Doreen Kimura and Michael W Carson, 'Dermotophyphic Assymetry: Relation to Sex, Handedness and Cognitive Pattern' (1995) 19 *Personality and Individual Differences* 471; Lindsy A Elkins, 'Five Foot Two with Eyes of Blue: Physical Profiling and the Prospect of a Genetics-Based Criminal Justice System' (2003) 17 *Notre Dame Journal of Law, Ethics and Public Policy* 269.

41 Koops and Schellekens (n 37) 166–8.

42 Examples include Australia and Spain. See Australian Law Reform Commission, Human Genetics Commission, *Inside Information: Balancing Interests in the Use of Personal Genetic Data* (2002), www.alrc.gov.au/publications/39-forensic-uses-genetic-information/function-creep; Koops and Schellekens (n 37) 167.

43 For example, in Art III(1) and (2) of the European Council Resolution of 25 June 2001 (OJ C187/1), member states are urged to only share the results of DNA analysis of non-coding chromosome regions. It is also explicitly stated that, in the event that science develops to the extent that it can be determined that any of the DNA makers that are currently used in forensic investigations provide information on

typing is to a limited extent legally permissible.[44] Gender is an example of a biological trait that can be determined through DNA analysis, and this is already included in current methods of DNA analysis that are used for the purposes of criminal proceedings across the globe. To trace other biological and personality characteristics, however, is far more complicated and more research is indeed warranted. However, as DNA technology advances, there may be increasing pressure to expand traditional non-coding analysis to explore the possible advantages that DNA Phenotyping may hold in a forensic setting.[45] However, as will be evident from the discussion below, even if the technology continues to progress, many phenotypical characteristics may be too multifactorial and complex to ever find specific correlated genotypes at all.[46]

3.1 Indirect Phenotyping

In 1993, British forensic scientist Evett Buckleton published the results of the first DNA test that could provide intelligence information along ethnic lines for use in forensic

specific hereditary characteristics, then member states are recommended not to continue using those specific markers when exchanging DNA analysis results. See also the Convention on the Stepping Up of Cross-Border Cooperation, Particularly in Combating Terrorism, Cross-Border Crime and Illegal Migration, Art 2(2), 27 May 2005. For the legal stance in Belgium see Council Secretariat, Brussels, 7 July 2005, Document no 10900/05, 44ter §3 Belgian DNA Act 22 March 1999, BS 20 May 1999; Proceedings of the Belgische Kamer van volksvertegenwoordigers (Second Chamber), 5th Session of the 49th Legislature, 1047/6–96/97, 18 February 1999 (Bel). In Germany, Article 81e of the German Code of Criminal Procedure (Strafprozeβordnung) governs the use of non-coding DNA in criminal matters. And statutes in Indiana, Rhode Island and Wyoming USA also prohibit the use of data in their DNA databanks for DNA phenotyping: Ind Code Ann §10-13-6-16 (West 2004), RI Gen Laws §12-1.5-10 (2007), and Wyo Stat Ann §7-19-404 (2007). See Koops and Schellekens (n 37) 166.

44 Indirect DNA phenotyping is permissible and legally regulated in the Netherlands and Japan. In the UK, DNA phenotyping is not regulated but was included in the services offered by the erstwhile Forensic Science Service (FSS), which was closed down on 31 March 2012, and is now offered by the private sector organisations to whom forensic work is now contracted. The indirect DNA phenotyping service offered by the FSS was known as the 'ethnic inference service': see Robin Williams, Paul Johnson and Paul Martin, *Genetic Information and Crime Investigation: Social, Ethical and Public Policy Aspects of the Establishment, Expansion and Police Use of the National DNA Database*, Project Report, Durham University, School of Applied Social Sciences (2004), 111. In the Netherlands, race and gender may be determined in terms of Wet van 8 Mei 2003 tot wijziging van de regeling van het DNA-onderzoek in strafzaken in verband met het vastellen van uiterlijk waarneembare persoonskenmerken uit celmateriaal (Act of 8 May 2003 to adapt the regulation of Forensic DNA Investigation in Relation to determining externally perceptible personal characteristics from cell material) Staatsbald van het Koningkrijk der Nederlanden 201 (2003) (Neth); see Koops and Schellekens (n 37) 166.

45 This phenomenon is generally referred to as function creep and refers to gradual change in previously authorised arrangements of control and surveillance being applied to purposes and targets beyond those envisaged at the time of installation. See Johanne Yttri Dahl and Ann Rudinow Saetnan, 'It All Happened So Slowly: On Controlling Function Creep in Forensic DNA Databases' (2009) 37 *International Journal of Law, Crime and Justice* 83; *Inside Information* (n 42).

46 Koops and Schellekens (n 37) 161.

investigations.[47] This method is now referred to as indirect phenotyping and is generally used to trace the external characteristics of an unknown perpetrator by determining the geographical or ethnic origin of that person.[48] The method is based on the premise that some mutations in DNA have occurred at certain loci in lieu of evolutionary advantages and in terms of how people have developed in their society, territory and family.[49] It is suggested that these mutations can be used as an indicator of man's spread across the globe and the subsequent development of different external region-specific features.[50]

The indirect DNA phenotyping process evaluates the approximately 5.0% of 0.1% of the identified locations in the human genome at which alleles vary in frequency among populations from different continents. The results are used to make statistical predictions about where a person's recent ancestors are located.[51] Some of the external characteristics that can be determined by means of an indirect phenotyping analysis are skin colour, hair type, and the shape of the eyes and face.[52]

However, this method also has some limitations: The size of the region to which an unknown perpetrator can be traced, within a degree of probability, is dependent on the geographical stability of that population as well as the availability and accessibility of databases with DNA characteristics of the specific populations. Interracial mingling may furthermore complicate the determination of an exact geographic origin. Most geneticists agree, for example, that race and ethnicity are not biologically determined categories and that greater genetic variation exists within racial groups than between them.[53] In addition, the outcome of an indirect phenotyping analysis with regard to geographic origin is of limited value as the unknown perpetrator may no longer be living in that region.[54]

47 Ian W Evett, John S Buckleton, A Raymond and Henry Roberts, 'The Evidential Value of DNA Profiles' (1993) 33 *Journal of the Forensic Science Society* 243.

48 Ethnicity is different from race. 'Ethnic groups are groups of people that share characteristics that include geographical and ancestral origins, culture and languages. Racial groups share biology or genes.' Kristina Staley, 'The Police National DNA Database: Balancing Crime Detection, Human Rights and Privacy' Genewatch UK (2005), www.genewatch.org/uploads/f03c6d66a9b354535738483c1c3d49e4/NationalDNADatabase.pdf.

49 Evett *et al* (n 47); Koops and Schellekens (n 37) 163; Pete Gill, Susan Woodruffe, Joan E Lygo and S Emma Millican, 'Population Genetics of Four Hypervariable Loci' (1991) 104 *International Journal of Legal Medicine* 221; Karen Rothenberg and Alice Wang, 'The Scarlet Gene: Behavioural Genetics, Criminal Law, and Racial and Ethnic Stigma' (2006) 69 *Law and Contemporary Problems* 343, 347.

50 Koops and Schellekens (n 37) 162; John H Wetton, Kam W Tsang and Haroon Khan, 'Inferring the Population of Origin of DNA Evidence within the UK by Allele-Specific Hybridization of Y-SNPs (Y-single nucleotide polymorphisms)' (2005) 152 *Forensic Science International* 45.

51 Pilar Ossorio and Troy Duster, 'Race and Genetics' (2005) 60 *American Psychologist* 115, 118.

52 See alsp the International HapMap Project that aims to identify and catalog genetic similarities and differences in human beings: http://hapmap.ncbi.nlm.nih.gov/thehapmap.html.en.

53 Rothenberg and Wang (n 49) 343, 347.

54 Koops and Schellekens (n 37) 163; Oscar Lao, Kate van Duijn, Paula Kersbergen, Peter de Knijff and Manfred Kayser, 'Proportioning Whole-Genome Single-Nucleotide-Polymorphism Diversity for the Identification of Geographic Population Structure and Genetic Ancestry' (2006) 78 *American Journal of Human Genetics* 680; Staley (n 48) 31.

It therefore seems that the identified genetic markers for determining geographical or ethnic origin will at best be able to indicate whether a person's ancestral background lies in one of four distinct historical populations, ie East Asian, European, Native American or African.[55] It must also be noted that many people might not want to know their ancestry and knowledge thereof may result in discrimination and stigmatisation.[56] Yet, despite these limitations indirect phenotyping can still be an effective investigative tool where the external perceptible characteristics of people from a particular ethnic group or geographical location are very distinct.[57]

Indirect phenotyping has also been used to predict the surnames of unknown persons on the basis of markers on the Y chromosome. In theory, this is possible because just as Y chromosomes are passed on from fathers to sons, so are surnames transferred in the male lineage in those countries where a patrilineal transfer of surnames is common.[58]

3.2 Direct Phenotyping

The external characteristics or bodily features of a person can also be determined through direct phenotyping. It is said that a considerable correlation exists between genes and appearance and that many human phenotypes—including stature, facial features, pigmentation, build and shape of the face and skull, eye colour and hair type—have a strong genetic component.[59] In the United Kingdom, for example, the 'red hair test' is used to identify whether the donor of a DNA sample has red hair. This test is based on the identification of differences in individuals' DNA within the specific gene that is known to determine hair pigmentation (the MC1R gene).[60] And, since 2003, the UK police have also made a determined commitment to research and further develop methods to predict and determine physical characteristics from DNA.[61]

However, it cannot be said that genes 'code for' a person's physical features, because although these features may have a strong genetic component, it is also recognised that combinations of several genes and a variety of environmental stimuli will impact on,

55 Staley (n 48) 31.

56 Ossorio and Duster (n 51)118; Ossorio (n 38) 286; Rothenberg and Wang (n 49) 343–65; Elkins *et al* (n 40) 286.

57 Wetton, Tsang and Haroon (n 50) 49; Koops and Schellekens (n 37) 161; Paula Kersbergen *et al*, 'Developing a Set of Ancestry-Sensitive DNA Markers Reflecting Continental Origins of Humans' (2009) 10 *BMC Genetics* 69; Ossorio and Duster (n 51) 115–28.

58 Koops and Schellekens (n 37) 163; Turi E King, Stephane J Ballereau, Kevin E Schürer and Mark A Jobling, 'Genetic Signatures of Co-Ancestry within Surnames' (2006) 16 *Current Biology* 384; Bryan Sykes and Catherine Irven, 'Surnames and the Y Chromosome' (2000) 66 *American Journal of Human Genetics* 1417.

59 Koops and Schellekens (n 37) 164; Guan Zhu *et al*, 'A Genome Scan for Eye Colour in 502 Twin Families: Most Variation is Due to a QTL on Chromosome 15a' (2004) 7 *Twin Research* 197.

60 Williams, Johnson and Martin (n 44) 111; Koops and Schellekens (n 37) 173.

61 Williams, Johnson and Martin (n 44) 112.

and ultimately determine, a person's physical appearance.[62] However, science is making rapid progress in further delineating the relationship between certain phenotypes and the external characteristics or bodily features of a person.[63]

In addition to determining the bodily features and external characteristics of a person, direct DNA phenotyping can also be used to shed light on a person's unique behavioural characteristics. Recent studies suggest that all human behaviour has a genetic component and that genes affect behaviour through 'how they encode the physical structure and the regulatory mechanism of neurobiological systems'.[64] For example, behavioural genetic research involving animal studies, family studies, twin studies and population studies has revealed a statistical correlation between certain genes and certain types of behaviour.[65] And specific chromosomes have been identified that correlate with a propensity for smoking,[66] left-handedness[67] and adult stuttering.[68] Genetic loci, associated with molecular pathways that lead to diagnosable psychiatric conditions like depression,[69] bipolar disorder[70] and schizophrenia,[71] have also been identified.[72]

Probably the strongest evidence that behaviour is at least partially determined by genetics can be found in twin studies. Several large-scale twin and adoption studies of criminality have shown that twins who are genetically identical show greater similarity in phenotypes than twins who only share an average of 50% genes.[73] However, in lieu of the complexity of these quantitative traits (there are few if any specific behaviours

62 Koops and Schellekens (n 37) 159, 164; Plomin *et al* (n 1) 251.

63 Koops and Schellekens (n 37) 164–5.

64 Lisa Schriner Lewis, 'The Role Genetic Information Plays in the Criminal Justice System' (2005) 47 *Arizona Law Review* 519, 521, 524.

65 Mark Rothstein, 'Applications of Behavioural Genetics: Outpacing the Science?' (2005) 6 *Nature Reviews: Genetics* 793; Lewis (n 64) 536; Baker, Bezdijan and Raine (n 35) 8; Soo H Rhee and Irwin D Waldman, 'Genetic and Environmental Influences on Antisocial Behavior: A Meta-Analysis of Twin and Adoption Studies' (2002) 128 *Psychological Bulletin* 490.

66 See OMIM, Tobacco Addiction, Susceptibility to, www.ncbi.nlm.nih.gov/entrez/dispomim.cgi?id=188890; Joanna S Fowler *et al*, 'Inhibition of Monoamine Oxidase B in the Brains of Smokers' (1996) 379 *Nature* 733.

67 See OMIM, Handskill, Relative, www.ncbi.nlm.nih.gov/entrez/dispomim.cgi?id=139900.

68 See OMIM, Stuttering, Familial Persistent 1, www.ncbu.nlm.nih.gov/entrez/dispomim.cgi?id=188450; Koops and Schellekens (n 37) 165.

69 B Arias *et al*, 'The 5-HT(2A) Receptor Gene 102T/C Polymorphism is Associated with Suicidal Behavior in Depressed Patients' (2001) 105 *American Journal of Medical Genetics* 801.

70 G Sipholt *et al*, 'Examination of IMPA1 and IMPA2 Genes in Manic-Depressive Patients: Association between IMPA2 Promoter Polymorphisms and Bipolar Disorder' (2004) 9 *Molecular Psychiatry* 621.

71 Samuel H Barondes *et al*, 'Workshop on Schizophrenia' (1997) 94 *Proceedings of the National Academy of Sciences* 1612.

72 Rothstein (n 65) 794, 798.

73 See also section 3 where it was held that every individual's DNA is unique except for identical twins; Baker, Bezdijan and Raine (n 35) 18; Plomin *et al* (n 1) 252; Laura A Baker, 'Methods for Understanding Genetic and Environmental Influences in Normal and Abnormal Psychology' in Stephan Strack (ed), *Differentiating Normal and Abnormal Personality* (Springer, 2nd edn 2006) 257; Rhee and Waldman (n 65).

attributable to a single gene),[74] biological factors[75] and the variability introduced by environmental and social differences[76] would, at best, be able to provide a suggestion or a likelihood of these characteristics or behaviours being present in the carrier of the genes.[77]

4. BEHAVIOURAL GENETICS AND THE LAW

The relationship between the law and behavioural genetics[78] has been long and troublesome. In the late nineteenth century, criminologist Cesare Lombroso claimed that criminals were 'atavistic throwbacks to the apes, characterised by physical stigmata, as well as a high threshold for pain, an inability to blush and a propensity for tattoos'.[79] And, in the early 1900s, the law took cognisance of developments in behavioural genetics with regard to studies claiming to prove a genetic basis for low intelligence and antisocial behaviour among immigrants to the USA. Similarly, a scientific claim to a genetic basis for immorality and mental defects prompted the enactment of eugenic sterilisation laws in Western Europe and in some states of the USA at the beginning of the twentieth century.[80] Probably the most notorious example is the role that behavioural genetics played in Nazi claims of racial superiority.[81]

Most genetics research in the twentieth century focused on classical transmission genetics[82] and molecular genetics,[83] involving the study of single genes.[84] Classical genetic designs do not involve the direct examination of DNA but rather 'infer observed

74 It is said that behaviours that are influenced by genes are inherited in a polygenic fashion, meaning that a number of different genes are involved in the expression of a single characteristic. See Lewis (n 64) 525.

75 For example, the influence of neurotransmitters, physiological arousal, frontal lobe function and hormones, as well as organic defects caused by drug use during pregnancy. Lewis (n 64) 524; Baker, Bezdijan and Raine (n 35) 8.

76 For example, socio-economic status, peer characteristics, parental monitoring and discipline, marital status and neighbourhood. See Lewis (n 64) 524; Baker, Bezdijan and Raine (n 35) 8.

77 William R Clark and Michael Grunstein, *Are We Hardwired? The Role of Genes in Human Behaviour* (Oxford University Press, 2000) 75; Koops and Schellekens (n 37) 165; Rothstein (n 65) 793; Lewis (n 64) 524; Plomin *et al* (n 1) 251.

78 Behavioural genetics is the study of genetic and environmental contributions to individual variations in human behaviour. See www.ornl.gov/sci/techresources/Human_Genome/elsi/behavior.shtml.

79 Erica Beecher-Monas and Edgar Garcia-Rill, 'Genetic Predictions of Future Dangerousness: Is there a Blueprint for Violence?' (2006) 69 *Law and Contemporary Problems* 301.

80 For example, in the 1960s and 1970s babies were also screened for XYY syndrome, which was then considered to be related to a propensity for crime. See Koops and Schellekens (n 37) 196; Nuffield Council on Bioethics, *Genetics and Human Behaviour: The Ethical Context* (London, 2002) xx.

81 Rothstein (n 65) 793.

82 Studies on the role of heredity in human behaviour, and how/which genes are inherited, and what properties of an organism it affects, emerged at the end of the nineteenth century. See Rothstein (n 65) 793.

83 Molecular genetics involves the study of the structure, function and regulation of the underlying gene; Plomin *et al* (n 1) 261.

84 Clark and Grunstein (n 77) 83; Baker, Bezdijan and Raine (n 35) 9; Baker (n 73) 257–82.

individual differences (or phenotypic variances) in a given trait, such as antisocial behaviour, through the examination of patterns of resemblance among individuals who are related genetically, environmentally, or both'.[85] Classical genetic designs are therefore useful in identifying broad classes of genetic and environmental influences on complex traits.[86] Today, however, a variety of genetic designs are used to identify specific genes with associations to, or genes of functional importance to, behaviour.[87]

Studies of QTLS,[88] for example, involve genes that show small but significant associations with complex (quantitative) traits. QTLS studies are important for the purposes of this discussion as they assist in identifying DNA sequences/markers that increase the risk of antisocial behaviour.[89] QTLS study designs apply either a population approach, where unrelated individuals with varying DNA sequences are compared on some aspect of antisocial behaviour, or a within-family approach, where two or more genetically varying relatives are compared.[90] Multivariate genetic modules like the measured risk factor approach, on the other hand, study various risk factors that are known to be partially inheritable and that are known to correlate with antisocial behaviour.[91]

This research has shown that genes affect the physiological structure and regulatory mechanisms of biological systems like the brain and neural pathways. They also provide the code for the chemicals (including neurotransmitters, enzymes, hormones and receptors) that control most of the body's functions, including brain function and human behaviour.[92] While environmental, social and other biological factors such as nutrition and personality traits[93] certainly contribute to and influence an individual's behavioural characteristics, research has shown that genetics may play a more important role than we might initially have thought.[94]

Some of the neurochemicals that have been linked to impulsive, violent and/or aggressive behaviour are serotonin, dopamine and monoamine oxidase (MAO).[95] Low serotonin levels in the brain have been linked, for example, to impulsive, aggressive and violent behaviour.[96] Several genes are involved in the production of dopamine,

85 Baker, Bezdijan and Raine (n 35) 9. Also referred to as quantitative genetics.

86 *Ibid*, 12.

87 *Ibid*; Baker (n 73) 257–82.

88 Quantitative Trait Loci Approach.

89 Plomin *et al* (n 1) 265; Jonathan Kaplan, 'Misinformation, Misrepresentation, and Misuse of Human Behavioural Genetics Research' (2006) 69 *Law and Contemporary Problems* 47, 68–72.

90 Baker, Bezdijan and Raine (n 35), 12; Plomin *et al* (n 62) 265.

91 Baker, Bezdijan and Raine (n 35), 30; Plomin *et al* (n 62) 266; Baker (n 73) 258.

92 Lewis (n 64) 538; Clark and Grunstein (n 77) 170; Rothstein (n 65) 794.

93 Personality traits that also correlate with antisocial behaviour include impulsivity and cognitive factors such as attention and execution-function deficits such as attention deficit hyperactivity disorder (ADHD); Baker, Bezdijan and Raine (n 35) 24.

94 Lewis (n 64) 538. Rothstein (n 65) 794; Terrie E Moffitt, 'Genetic and Environmental Influences on Antisocial Behaviours: Evidence from Behavioural-Genetic Research' (2005) 55 *Advances in Genetics* 41.

95 Baker, Bezdijan and Raine (n 35) 34.

96 Lewis (n 64) 538; Baker, Bezdijan and Raine (n 35) 34.

and genetic defects in dopamine metabolism have been linked to aggressive behaviour, including psychosis.[97] Similarly, a strong link exists between monoamine oxidase (MAO)[98] and certain types of criminality, especially those that involve psychopathy, aggression and violent behaviour.[99]

Although it remains difficult to establish definitive links between behavioural disorders and genes, it is now possible to make more accurate predictions about the influence of genetic factors on an individual's behaviours.[100] A person's genetic make-up may therefore be a powerful indicator—together with a consideration of environmental influences, underlying biological conditions and personal choice—of a person's propensity for violent or aggressive behaviour. The potential role that behavioural genetics can play in explaining criminal behaviour, identifying individuals with a predisposition for violent and anti-social behaviour even before such behavioural characteristics have manifested, determining criminal responsibility,[101] and whether such a genetic link warrants pre-emptory legal action, including mandatory treatment, are therefore worth considering.[102]

However, we have also come a long way since the eugenics movement of the early nineteenth century and geneticists now agree that genetics alone can never explain (or excuse) an individual's behaviour completely, even with all the knowledge about that individual's genetic predispositions and specific environmental, biological and social circumstances.[103] Behaviour ultimately involves a strong element of individual choice, and a genetic propensity for criminal behaviour is only a 'calculation of the probability for violence' and is not an absolute indicator that the person will commit a violent or aggressive act.[104] Clark and Grunstein articulate it as follows: 'As with any behavior, it is a propensity to violence and aggression that is inherited, not the behavior itself.'[105]

As already indicated in sections 1 and 2 above, this paper focuses only on the potential role that behavioural genetics can play in the post-conviction stages of a criminal proceeding; where an offender has already committed and been convicted of a crime, and where his/her propensity for violent or aggressive behaviour and the likelihood that

97 Lewis (n 64) 539; Baker, Bezdijan and Raine (n 35) 35.

98 Especially low levels of MAO A and MAO B, the two enzymes that metabolise dopamine, serotonin and other chemicals.

99 Lewis (n 64) 539; Baker, Bezdijan and Raine (n 35) 35–37; Hakan Garpenstrand *et al*, 'Low Platelet Monoamine Oxidase Activity in Swedish Imprisoned Criminal Offenders' (2002) 12 *European Neuropsychopharmacology* 135; Clark and Grunstein (n 77) 171.

100 Rothstein (n 65) 793; Lewis (n 64) 539.

101 For example, can a link between a particular gene and certain behavioural characteristics be used as a defence or excuse for criminal behaviour? See Daniel P Greenfield, 'Criminal Responsibility from a Clinical Perspective' (2009) 37 *Journal of Psychiatry and Law* 7.

102 Lewis (n 64) 540; Manfred Kayser and Peter de Knijff, 'Improving Human Forensics through Advances in Genetics, Genomics and Molecular Biology' (2011) 12 *Nature Reviews: Genetics* 179.

103 Baker, Bezdijan and Raine (n 35) 38.

104 Lewis (n 64) 524; Rothenberg and Wang (n 49) 354.

105 Clark and Grunstein (n 77) 174.

he/she will exhibit criminal behaviour again can be taken into consideration in determining a just punishment and an appropriate rehabilitative sentence.[106] In the following discussion it will be shown that the application of behavioural genetics in the sentencing phase of criminal proceedings can be beneficial to both the offender and society at large. And the potential for human rights violations with regard to the sensitive and private nature of the genetic information divulged about an offender is limited as it is only considered once the offender has been convicted of a violent crime that warrants an enquiry into any genetic predispositions.

4.1 DNA as a Mitigating Factor at Sentencing

During the sentencing phase of criminal proceedings, courts already take into account a number of social science-based opinions and inferences[107] about offenders' propensity to engage in criminal behaviour as well as the influence that environmental and social circumstances may have had on such behaviour. This is often done without hearing any expert opinions or evidence, and without really knowing or understanding how the mechanisms by which external influences, such as the offender's environment or social circumstances, influence their behaviour.[108] There should therefore, in principle, also be no objection to allowing behavioural genetics evidence on offenders' propensity for violent or aggressive behaviour and the likelihood that they will exert such criminal behaviour in the future. Such evidence should, however, be based on sound scientific principles and be convincing as well as relevant to the case at hand.[109]

In the USA the Federal Sentencing Policy explicitly supports the idea that genetic disorders may play a mitigating role in sentencing proceedings.[110] However, in 1994 the Georgia Supreme Court rejected behavioural genetic evidence of convicted murderer Stephan Mobley, stating that behavioural genetics 'will not have reached a scientific stage of verifiable certainty in the near future and Mobley could [therefore] not show that such a stage will ever be reached'.[111] Mobley continued to appeal his case and in 1998 the

106 Lewis (n 64) 523, 540, 545. For practical reasons this paper will not consider cases and literature where genetic evidence was submitted in support of other claims. The discussion in 4.1 and 4.2 below will be limited to the potential role of behavioural genetic evidence with regard to predispositions towards future violent and antisocial behaviour and specifically for the mitigation of a sentence or for the purpose of rehabilitation programmes.

107 For example, psychological and social aspects pertaining to the offender's life and upbringing, his environment as well as socio-economic situation and any reports or opinions provided by social workers, psychologists and/or psychiatrists.

108 Nuffield Council on Bioethics (n 80) 14.26; Beecher-Monas and Garcia-Rill (n 79) 301.

109 See above, section 2 of this paper; Lewis (n 64) 541.

110 US Sentencing Guidelines Manual § 5K2.13 (1998); Lewis (n 64) 545; Amanda Evansburg, 'But your Honor, it's in his Genes: The Case for Genetic Impairments as Grounds for a Downward Departure under the Federal Sentencing Guidelines' (2001) 38 *American Criminal Law Review* 1565.

111 *Mobley v State* 455 SE 2d 61 (Ga 1995), 66; Deborah W Denno, 'Revisiting the Legal Link between Genetics and Crime' (2006) 69 *Law and Contemporary Problems* 209, 210.

Georgia Supreme Court again denied consideration of the potential for testing Mobley for genetic deficiencies, this time stating that while 'Mobley had in fact been able to present the genetics theory through a relative's testimony about the family's generations of behavioural problems … there had been no showing that a geneticist would have offered additional significant evidence'.[112] Mobley was eventually executed by lethal injection in March 2005.[113] The most recent case in which behavioural genetic evidence was submitted in mitigation of a sentence was in 2009, when Abdelmalek Bayout's original sentence of just over nine years was cut by a year based on behavioural genetic evidence that he had five genes that are associated with violent behaviour.[114]

Yet an offender's genetic predisposition to commit criminal actions can also be regarded as an aggravating factor, as was the case in *Landrigan v Stewart.*[115] In this case the Ninth Circuit Court of Appeals dismissed the offender's claim to introduce genetic evidence in mitigation of his sentence. It was held that 'the rather exotic … genetic violence theory [proposing that] Landrigan's biological background [had] made him what he is' would not have affected the outcome of the trial as it only confirmed that he (Landrigan) would continue to be violent in future.[116] Nikolas Rose described this as follows: 'If antisocial conduct is inscribed in the body of the offender, it seems as that it is not mitigation of punishment that is required but the long-term pacification of the irredeemable individual in the name of public protection, even if this means the rejection of many rule of law considerations, such as those concerning the proportionality of crime and punishment'.[117] However, on appeal in 2006 it was held that Landrigan's claims that he may have been genetically predisposed to violence are (if true) 'the very sort of mitigating evidence that might well have influenced the [judge's] appraisal of [Landrigan's] moral culpability'.[118]

It is submitted that genetic science research has developed to such an extent that it is now known that the presence of complex genetic variants, together with particular social, biological and/or environmental factors, increases the likelihood that some individuals will develop behavioural traits that make them more likely to engage in criminal

112 *Turpin v Mobley*, 502 SE 2d 458, 463 (Ga 1998), 463–7 and 466. See Denno (n 111) 211.

113 Denno (n 111) 211.

114 'The Get Out of Jail Early Gene: The Sentence of One Killer in Italy has been Reduced as he Possesses a "Violent Gene"' *The Times* (London), 17 November 2009, 32; 'Criminal Gene "Should Mean Lighter Sentence"' *The Times* (London), 2 October 2002, 5.

115 *Landrigan v Stewart*, 272 F 3d 1221, 1229 (9th Cir 2001) *vacated*, *reh'g en banc granted*, 397 F 3d 1235 (9th Cir 2005), *aff'g in part, rev'g in part*, *Landrigan v Schriro*, 441 F 3d 638 (9th Cir 2006) (*en banc*); *Landrigan v Stewart*, 272 F 3d 1221 (9th Cir 2001) (No 00-99011) at 1225 and 1228; Rothenberg and Wang (n 49) 360.

116 *Landrigan v Stewart*, 272 F 3d 1221 (9th Cir 2001) (No 00-99011) at 1229; Denno (n 111) 228.

117 Nikolas Rose, 'The Biology of Culpability: Pathological Identity and Crime Control in a Biological Culture' (2000) 4 *Theoretical Criminology* 5.

118 *Landrigan v Schriro*, 441 F 3d 638 (2006) at 644–5; see also *Hendricks v Calderon*, 864 F Supp 929 (ND Cal 1994) aff'd 70 F 3d 1032 (9th Cir 1995); *Cauthern v State*, 145 SW 3d 571, 613 (Tenn Crim App 2004); *Alley v State*, 958 SW 2d 138 (Tenn Crim App 1997); *Von Dohlen v State*, 602 SE 2d 738, 743 (SC 2004), cert denied, 125 S Ct 1645 (2005).

activities. The importance of the interplay between these complex genetic variants and external influences cannot be emphasised enough. Knowing that genes are not deterministic and only predict a likelihood that an individual will engage in criminal behaviour debunks the common myth that the use of behavioural genetics in criminal proceedings will lead to new waves of eugenics like population-wide genetic screening for criminality.[119] And, knowing what we do now about the complex interplay between genes and the myriad of influences to which they may respond, it is also unlikely that offenders will be able to use behavioural genetics as an easy excuse to claim that their impulse control has been compromised by a genetic mutation and that their criminal behaviour should therefore be excused for that reason alone.[120] Judicial officers will furthermore exercise their discretion—as with all other information and factors that are taken into account when determining an appropriate sentence—and will decide what weight, if any, should be accorded to behavioural genetic evidence.

By taking into consideration the genetic predisposition of an offender, sentencing courts will be able to apply a multidisciplinary perspective of criminal behaviour and will be in a better position to pass sentences that are proportional to the offender's blameworthiness.[121] Lewis states that 'justice is not served by imposing similar sentences for similar crimes when the offenders have dissimilar capacities for self-control'.[122] It is furthermore relatively easy and inexpensive to genotype DNA once genes associated with complex traits have been identified.[123] And, as for the South African context, DNA samples of offenders will be available for a limited period of time in order for DNA Phenotyping tests to be conducted, should such information be needed in the post-conviction sentencing phase of a trial.[124]

However, the risk also exists that, through the recognition of an offender's genetic predisposition for criminal behaviour, such an offender may be regarded as a person with an essentially 'unsound character' and may, for that reason, be stigmatised and discriminated against.[125] This is a real concern in a country like South Africa, where we are still trying to deal with the aftermath of our political and social history of racial profiling and segregation. There are also concerns that some offenders may use their genetic predisposition 'green card' to become involved in further criminal activity.[126] Yet the

119 Katherine I Morley and Wayne D Hall, 'Is there a Genetic Susceptibility to Engage in Criminal Acts?' *Australian Institute of Criminology: Trends and Issues in Crime and Criminal Justice* (October 2003) 1–6; Evansburg (n 110) 1578.

120 Rothstein (n 65) 795; Evansburg (n 110) 1577.

121 Lewis (n 64) 545.

122 Lewis (n 64) 545–6.

123 Plomin *et al* (n 1) 265.

124 See section 2.2 above.

125 Nuffield Council of Bioethics (n 80) 14.29.

126 The impulse to treat genetics as the sole cause of a particular action is known as genetic reductionism. Genetic determinism, on the other hand, refers to the idea that a person is 'hardwired' to act in a certain way and has no control. Rothenberg and Wang (n 49) 356.

recognition that some people may have a genetic predisposition for criminal behaviour and may therefore not be able to resist negative environmental and social influences, or may—due to the influence of other biological factors—not be able to control their behaviour in a similar manner to other individuals may actually counter the usual stigmatisation and discrimination that offenders experience when they try to reintegrate into society after serving a custodial sentence.[127] It may even counter existing attitudes in South Africa about certain racial and ethnic groups and their involvement in criminal activities.

The potentially important role of behavioural genetic research in the sentencing phase of criminal proceedings in South Africa can therefore be summarised as follows:

- The application of behavioural genetic research during the post-conviction stages of criminal proceedings and in mitigation of sentence correctly reflects the science underpinning Forensic DNA Phenotyping and behavioural genetics; genetic impairments do not determine behaviour, but they may increase a person's propensity to engage in criminal behaviour.[128]
- South African courts already take a variety of influences on an offender's life course and criminal activities into account during the sentencing phase of criminal proceedings. Usually, they do this without hearing any expert evidence or opinion with regard to the real effect such influences may have had on the offender's decision to engage in a particular criminal act. While behavioural genetic evidence may therefore not meet the evidential standards usually applied in criminal trials, it should receive the same consideration as other influences that are already being considered in the sentencing phase of the proceedings.[129]
- As will be argued in the following section, the application of behavioural genetics in the post-conviction phase of criminal proceedings in South Africa may also assist with the current problems of overcrowding and the high rate of recidivism.

4.2 DNA and the Rehabilitation of Convicted Offenders

Lewis argues that 'to reduce sentences for offenders who are predisposed to commit violent crimes would be similar to rewarding the offenders who are most likely to repeatedly commit acts of violence, which is contrary to what such offenders deserve as punishment'.[130] Moreover, custodial sentences for offenders with a genetic predisposition to commit violent crimes can also exacerbate the perpetual cycle of violence: since 'violence [is in itself] a problem within prisons, and because environment … [plays such

127 See section 2.1 above.
128 Evansburg (n 110) 1579.
129 *Ibid*.
130 Lewis (n 64) 545.

an important role] in triggering a genetic disposition for violence, the highly stressful and hostile environment of most prisons' will only perpetuate the cycle of recidivism that is particularly evident in the South African context today.[131]

It is therefore important that offenders' genetic predispositions are taken into consideration in the design of correctional facilities and the selection of appropriate rehabilitative programmes that prisons offer. The field of behavioural genetics has, after all, provided us with the best evidence available regarding the importance of environmental influences on personality development.[132] Custodial sentences and ensuing rehabilitative programmes that address individuals' personal risk of engaging in criminal behaviour will therefore not only improve the chance of rehabilitative success, but successful treatment and medication may also address the serious problems of recidivism that South Africa is facing.[133] It is submitted that such a humanised and individual approach is furthermore in line with the emerging legal theory of 'therapeutic jurisprudence'[134] and the principles of human dignity.[135]

It is furthermore suggested that the application of genetics research in offender treatment and rehabilitation will lead to the development of new treatments for personality disorders that are associated with criminal behaviour like ASPD, DC, ADHD and ODD. It may also assist in diagnosing offenders who suffer from treatable psychological disorders.[136] Yet such increased medicalisation and dehumanisation of human behaviour may ultimately lead to another wave of eugenics.[137] Legislatures and courts must therefore ensure that they do not slide down a slippery slope towards 'mental profiling and an overly simplistic genetics-based explanation [and treatment] of behavior'.[138]

These observations are especially important for the South African context with our minimum sentencing legislation that mandates long minimum sentences for offenders and the severe problem of overcrowding that precludes proper rehabilitation and instead turns prisons into places where criminality is nurtured.

131 *Ibid*.

132 Plomin *et al* (n 1) 251, 256.

133 Lewis (n 64) 547.

134 See Bruce J Winick, 'Therapeutic Jurisprudence and Problem Solving Courts' (2003) 30 *Fordham Urban Law Journal* 1055.

135 Lewis (n 64) 547; Fagan (n 10) 5; Constitution of the Republic of South Africa (1996).

136 Morley and Hall (n 119) 5; David E Comings, 'The Role of Genetics in ADHD and Conduct Disorder: Relevance to the Treatment of Recidivisitic Antisocial Behavior' in DH Fishbein (ed), *The Science, Treatment and Prevention of Antisocial Behaviors: Application to the Criminal Justice System* (Civic Research Institute, Kingston, NJ, 2000) 16-1–16-25; David E Comings *et al*, 'Comparison of the Role of Dopamine, Serotonin, and Noradrenaline Genes in ADHD, ODD and Conduct Disorder: Multivariate Regression Analysis of 20 Genes' (2000) 57 *Clinical Genetics* 178, 196.

137 Nuffield Council on Bioethics (n 80) xx.

138 Elkins (n 40) 298.

5. CONCLUSION

It is important, with regard to the potential role that behavioural genetics can play in the post-conviction stages of criminal proceedings in South Africa (and elsewhere), that courts recognise the complex nature of human behaviour and apply a multidisciplinary approach—which includes social, biological and genetic variables—when sentencing offenders. It is ironic that courts usually rely on a number of social and environmental influences, sometimes even without having heard expert evidence, but claim that behavioural genetics is too dubious a science to be considered in the sentencing and rehabilitation phases of a criminal matter. Just as courts should not give DNA evidence and specifically behavioural genetic evidence any special privileges based on 'the misguided idea that DNA constitutes the sacred essence of an individual's personal identity',[139] they should also not give it any lesser privileges than those afforded to other forms of evidence during the sentencing phase of proceedings.

It is furthermore important that members of the public are educated as to the basic principles of behavioural genetics. The misconception that people are genetically 'hard-wired' to behave in a certain manner and that there is nothing that can be done about it must be addressed.[140] The importance that environmental and social conditions can play in personality development and antisocial behaviour must rather be emphasised and the common myth that an individual's genetic structure is static (genetic determinism) must be debunked.[141]

139 *Ibid*, 300.

140 Rothenberg and Wang (n 49) 356. This is also known as genetic reductionism and refers to the idea that a single gene is the sole cause of a particular trait, discounting all other influences, including the interaction with other genes, external influences such as the environment and an individual's own free will and choice.

141 Denno (n 111) 219; Plomin *et al* (n 1) 268; Elkins (n 40) 301.