THE SUPREME COURT OF APPEAL OF SOUTH AFRICA

JUDGMENT

Case No: 483/12
Reportable

In the matter between:

SANDILE BOKOLO **APPELLANT**

and

THE STATE **RESPONDENT**

Neutral citation: *Bokolo v S* (483/12) [2013] ZASCA 115 (18 September 2013)

Coram: Malan, Theron and Majiedt JJA and Van der Merwe and Zondi AJJA

Heard: **23 August 2013**

Delivered: **18 September 2013**

Summary: Evidence – weight to be attached to DNA profiling. DNA profile of appellant not included in crime scene samples – in any event no evidence of the probability of that occurrence – probabilities on the facts pointing to innocence – conviction of rape set aside.

ORDER

On appeal from: Western Cape High Court, Cape Town (Hlophe JP sitting as court of first instance):

1 The appeal is upheld.
2 The conviction and sentence are set aside.

JUDGMENT

VAN DER MERWE AJA (MALAN, THERON AND MAJIEDT JJA AND ZONDI AJA CONCURRING):

[1] During the evening of 30 or the early morning of 31 October 2004 a four year old girl was brutally raped and killed. Her father, the appellant, and another person (accused 2) were tried in the Western Cape High Court (Hlophe JP) on charges of the murder, rape and indecent assault of the child. The appellant was only convicted on the charge of rape and sentenced to 15 years' imprisonment. Leave to appeal against conviction and sentence was granted by this court.[1]

[2] The evidence establishes the following relevant facts. The girl lived in Harare, Khayelitsha with the appellant and her mother. Her mother bathed the girl during the morning of Saturday 30 October 2004, as she had on the previous morning. On both occasions the girl had no injuries and her mother noticed nothing untoward. On the contrary, at around 18h00 on the Saturday the girl was happily playing in the street with other children, whilst her mother was preparing to go to church. The girl wanted to go along and therefore accompanied her mother to the church, which is about a ten minute walk from their home.

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[1]Accused 2 was convicted on both the charges of murder and rape and sentenced to an effective term of imprisonment of 28 years. He was refused leave to appeal by the trial court as well as this court.

[3] The appellant was not at home at the time. He went to work and afterwards, at about 15h00, went to a shebeen across the street from his home. He remained at the shebeen until approximately 22h00. He was then in such a state of intoxication that the owner of the shebeen requested a patron to take the appellant home. The patron did so and the appellant went to sleep straight away.

[4] Whilst her mother and others were preparing vegetables at the church, the girl played with other children in a park. When the mother's work was done, she went to the bathroom, accompanied by the girl. She left the girl in the passage immediately outside the bathroom. She heard the girl calling for her and she assured the girl that she would be back shortly. However, when she emerged from the bathroom a few minutes later, the girl was missing. This took place at approximately 22h00.

[5] The mother, her other daughter and others searched for the girl in the churchyard and surrounding area but could not find her. She and her daughter then went home where they found the appellant in a drunken sleep. The police were called and several further efforts were made to find the girl, but at approximately 08h00 on 31 October 2004 a message was received that the girl's body had been found next to some bushes approximately 1,5 km from the church. The subsequent post mortem revealed that she suffered multiple tears of the vagina and probably died of asphyxiation.

[6] Later that same morning Captain Kinnear of the South African Police Service attended the scene where the body was found. He placed a clean sanitary pad on the private parts of the body in order to retain any fluid emanating therefrom. He made use of tape to keep the sanitary pad in place. It is common cause that samples from this sanitary pad were analysed for DNA at the Biology Unit of the Forensic Science Laboratory of the SA Police Service.

[7] In respect hereof the respondent presented the evidence of Colonel Sharlene Otto, employed as chief forensic analyst at the Biology Unit. Dr C J J

Oosthuizen testified in this regard in the case of the appellant. In order to evaluate the evidence it is necessary to refer to basic principles of DNA and the method of genetic profiling used in this case. In this respect I derived valuable assistance from the work *DNA in the Courtroom: Principles and Practice* by Prof Lirieka Meintjies-Van der Walt.[2]

[8] Deoxyribonucleic acid (DNA) is the genetic material that is passed from parent to child. There are two sets of DNA molecules in a human cell. One set is found in the nucleus of the cell (nuclear DNA) and the other in the mitochondria thereof. In what follows I refer to nuclear DNA.[3] The DNA molecules found in the nucleus of a human cell are the same in all cells of the human body. The DNA does not change during a person's lifetime. Except for identical twins each person's DNA is unique.[4]

[9] DNA is a double-stranded molecule composed of 46 sections termed chromosomes. A chromosome is a thread-like structure that carries genetic information arranged in a linear sequence. The chromosomes are arranged in 23 pairs. One chromosome per pair is inherited from each parent. The 23rd pair of chromosomes determines an individual's gender and differs from the others. An individual always receives an X-chromosome from the mother and either an X-chromosome or Y-chromosome from the father. Individuals with XX in the 23rd pair of chromosomes are female and those with XY are male. In what follows I concentrate on the other 22 pairs of chromosomes, called chromosomes 1 to 22.

[10] Each of these chromosomes consists of linked base pairs to form a ladder-like structure. The ladder is twisted into the so-called 'double helix'. The only difference between people is that every person has a different sequence of the base pairs in the chromosomes. Every person could therefore be identified solely by the sequence of his or her base pairs. But

[2]Meintjies-Van der Walt, *DNA in the Courtroom: Principles and Practice* (2010).
[3]Mitochondrial DNA is maternally inherited and not unique to an individual.
[4]Approximately 99,9 per cent of DNA in humans are in fact identical. This shared DNA creates human characteristics that are similar in all people. It is the approximately 0,1 per cent of DNA that is not shared that is different in every individual with the exception of identical twins. See Meintjies-Van der Walt supra at 3.

because there are a staggering number of approximately three billion base pairs in the DNA in each human cell nucleus, this is not practically possible.

[11] Scientists have however developed methods in which a small number of sequences of DNA are analysed at specific physical locations on a chromosome that are known to vary amongst individuals. Such a physical location on a chromosome is referred to as a locus (plural loci). These physical loci are referred to by codes. The codes of most loci refer to their physical locations, for instance segment 1358 of chromosome 3 is referred to as D3S1358 and segment 1179 of chromosome 8 is referred to as D8S1179, but there are also codes consisting of abbreviations of scientific terms.

[12] A gene is found at a particular locus on a particular chromosome. An allele is each of two forms of a gene at a particular locus. At each locus examined a person therefore has a pair of alleles, one maternal and one paternal. This pair of alleles is called a genotype. A pair of alleles may be identical if the same allele was inherited from both parents. A set of genotypes at two or more loci form a DNA profile.

[13] In this case short tandem repeat (STR) profiling was used. This form of DNA profiling is one of the most widely used. It makes use of the polymerase chain reaction (PCR) technique. This technique simulates the process which takes place when DNA is copied prior to the division of cells in the body and produces multiple exact copies of the DNA at the specific locus to be analysed.

[14] An STR is a short sequence of base pairs which is repeated numerous times in tandem. The number of repetitions varies among individuals. The number of repetitions is used to name an allele, therefore five repeats of a sequence is called allele 5. As a person has two alleles at each locus, an STR profile will for instance indicate that the alleles at a specific locus are 15:15, if that allele was inherited from both parents or 15:16, if these alleles were inherited from the respective parents. The system used by the SA Police Service determines alleles at 9 loci as well as gender, as explained above.

[15] The DNA fragments produced by PCR is subjected to a process called electrophoresis. This process produces a computer generated graph called an electropherogram. On an electropherogram the alleles at each locus are indicated as peaks on a baseline. If the individual received the same allele from each parent, the electropherogram of his DNA will indicate one peak at a specific locus, otherwise there will be two peaks. More than two peaks at a specific locus indicate that the sample is a mixture of DNA. The electropherogram assigns allele names to peaks. An STR profile is therefore a series of numbers that represent all the genotypes detected for each locus in a particular sample.

[16] The height of a peak on an electropherogram corresponds with the quantity of DNA present. An electropherogram may however also indicate material not naturally present in DNA. This is called an artefact.

[17] Evidence of DNA profiling may be of great significance in a given case. It is important, however, that evidence of DNA profiling be viewed in proper perspective in each case.

[18] Evidence that the STR profile of an accused person matches that of a sample taken at the scene or can be included therein, is circumstantial evidence. The weight thereof depends on a number of factors. These include:

(i) the establishment of the chain evidence, ie that the respective samples were properly taken and safeguarded until they were tested in the laboratory;

(ii) the proper functioning of the machines and equipment used to produce the electropherograms;

(iii) the acceptability of the interpretation of the electropherograms;

(iv) the probability of such a match or inclusion in the particular circumstances;

(v) the other evidence in the case.

[19] Paragraphs (i) and (ii) speak for themselves. Analysts provide interpretations of electropherograms referred to in paragraph (iii). The weight

of such expert opinion (and of conflicting opinions) depends on the extent to which the opinions are founded on logical and cogent reasoning.[5]

[20] If the STR profile of an accused person in fact differs from the profile retrieved from the sample taken at the scene, even in respect of only one allele, the accused person must be excluded as a source of the crime scene DNA.[6] However, the converse is not true. Because only a limited number of STR loci are analysed, an STR profile cannot identify a person.[7] Therefore the weight to be attached to evidence of an STR profile match or inclusion in the first place depends on the probability of such a match or inclusion occuring in a particular population. Without such evidence the STR profile match or inclusion means no more than that the accused person cannot be excluded as a source of the crime scene DNA.

[21] If the profile in question may be found in many individuals, a match between the profile of the accused person and the crime scene DNA will have little or no probative value. This is of particular importance where the crime scene DNA is a mixture, which increases the likelihood that the profiles of other members of the population can be read into the mixture. On the other hand an extremely rare profile will strongly point to the involvement of the accused person. This essential component of DNA evidence is usually presented in the form of statistical analyses of a population database. This is a complex topic that does not in this case require further elaboration than the following general remarks.

[22] First, the more loci are included in the profile the less chance there is of another person adventitiously fitting the profile.[8] Second, statistical

[5]See *Michael & another v Linksfield Park Clinic (Pty) Ltd & another* 2001 (3) SA 1188 (SCA) paras 36 and 37; *Buthelezi v Ndaba* [2013] ZASCA 72 (29 May 2013) para 14.
[6]This is the evidence of both Colonel Otto and Dr Oosthuizen. See also *People v Brown* 1991 Cal App 4th 623.
[7]Meintjies-Van der Walt supra at 9. *People v Brown* supra at 629.
[8]Dr Oosthuizen, who was called by the appellant, conceded in evidence that analyses at 9 STR loci plus the gender marker is sufficient. In the United Kingdom tests are performed for 11 loci, including the gender marker. In the United States 13 loci are used as well as the gender marker. Prof Meintjies-Van der Walt relates that the inventor of DNA profiling, Sir Alec Jeffereys, has suggested that 15 to 16 loci should be used in England as a result of the size

calculations of this nature generally make use of the product rule. This rule postulates that the probability of several things occurring together is the product of their separate probabilities. It calculates the numerical probability that a particular profile may occur in a population or, in its alternative form, the numerical probability that a person randomly chosen from that population will possess the same genetic profile. The important point is that the results of these calculations are not absolute.

[23] This brings into play the other evidence in a case. I cannot conceive of a criminal case where there is absolutely no other relevant evidence or evidentiary material. This may range from direct eyewitness evidence implicating the accused to circumstantial evidence as mundane as the proximity of the home of the accused to the scene of the crime. This may of course also include evidence pointing to the innocence of the accused. In the final analysis this evidence determines whether the guilt of the accused has been proved beyond reasonable doubt or not.

[24] Applying these principles to this appeal, the undisputed evidence is that in respect of two samples or cuttings taken from the sanitary pad that was placed by Captain Kinnear, electropherograms were produced in the manner explained above. These two samples were referred to in evidence as pad 1 and pad 2 respectively and for convenience I do the same. These electropherograms show that both samples contain a mixture of DNA. According to Colonel Otto, the combination of alleles on the electropherograms in respect of both pads 1 and 2 reflect the DNA of at least three males.

[25] The STR profile of the appellant is also not in dispute. The alleles thereof at the respective loci coincide with the combination of alleles reflected on the electropherograms of pad 1 and pad 2, except for the appellant's allele 22 at locus FGA. Although there is an indication (referred to in evidence as a little block) at the relevant place on each of these electropherograms, neither reflects a peak labelled allele 22 at locus FGA. The alleles on these

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of the database. See Meintjies-Van der Walt supra at 43-44 and 84.

electropherograms at locus FGA are in fact 20, 25 and 26 (in respect of pad 1) and 21, 23, 24 and 25 (in respect of pad 2).

[26] Nevertheless the evidence of Colonel Otto was that as a matter of interpretation of the electropherograms they indicate allele 22 at locus FGA and that the STR profile of the appellant could therefore be read into the mixture reflected on the electropherograms of pads 1 and 2. She said the following:

'M'Lord, at that point FGA 22:25, you will see that there is not a clearly marked 22 at FGA. A possible reason for this is that FGA is a huge ─ is one of the largest, how can I put it, largest areas in the DNA molecule, so obviously when you have DNA donated by quite a few people, you can actually lose some of your bigger fragments. So although there is not a labelled 22, we do have indications of DNA being present where we would expect to see a 22, so we can actually interpret it as such.'

[27] On the other hand the evidence of Dr Oosthuizen was to the following effect. Because the height of a peak on an electropherogram is proportional to the quantity of DNA, alleles not detected in a less enriched sample of DNA may be indicated as a peak in the more enriched sample thereof. Therefore a hint of DNA in a less enriched sample, if it represents DNA, should constitute a peak in the more enriched sample. A more enriched sample in this context simply means that it contains a greater quantity of the DNA than the less enriched sample. Pad 1 in this case contains a greater quantity of DNA than pad 2. Pad 1 is the sample more enriched with sperm and therefore the electropherogram thereof presents a much clearer picture than that of pad 2. There is a little block on the electropherogram of pad 2 that hints at DNA where one would find allele 22 at locus FGA. However, if that was DNA, it should have been represented as a labelled peak and therefore an allele on the electropherogram of pad 1. In the absence of any other explanation, it must be concluded that allele 22 cannot be detected at locus FGA on the electropherograms of either pad 1 or pad 2 and that the little block is in fact an artefact.

[28] The court a quo preferred the evidence of Colonel Otto to that of Dr Oosthuizen. The court based this finding essentially on three grounds. First, it said Dr Oosthuizen only gave evidence in respect of the electropherograms and did not personally examine 'the specimen', presumably referring to the samples. Second, Dr Oosthuizen gave no evidence in respect of control measures in the laboratory as was alluded to by Colonel Otto and third, that Dr Oosthuizen 'never gave evidence relating to the basis of his conclusions'.

[29] None of these reasons bear any scrutiny. Neither the examination of the samples nor the control measures used in the laboratory have any relevance to the issue on which the experts disagreed, namely the proper interpretation of the electropherograms. Colonel Otto made it clear that her interpretation is based on what is reflected on the electropherograms that she brought to court and she did not say that there is anything on the originals thereof that cannot be detected on the copies that were made available to Dr Oosthuizen. And it is clear from what I have said that the statement that Dr Oosthuizen gave no basis for his conclusions, is simply wrong.

[30] In my judgement the evidence of Dr Oosthuizen should in fact have been preferred to that of Colonel Otto. Properly analysed the evidence of Colonel Otto quoted above, which was the only evidence by her on the point in issue, means no more than that it is possible that allele 22 at locus FGA may have been lost in the mixture. It does not exclude the reasonable possibility that that allele was never there.

[31] Dr Oosthuizen has a PhD in molecular human genetics and is experienced in the interpretation of electropherograms. He was an objective witness who gave credit and made concessions when due. Importantly, his opinion that allele 22 cannot be detected at locus FGA on the electropherograms of pad 1 or of pad 2, is based on logical and cogent reasoning. It is scientifically accepted that a sample more enriched with DNA will show a higher peak on an electropherogram than the less enriched sample. It is not disputed that pad 1 was more enriched with male DNA (sperm) than pad 2. Dr Oosthuizen in evidence graphically illustrated this by

comparison of the electropherogram of pad 2 with that of pad 1. This accords with the evidence of Colonel Otto that semen was targeted when the samples were taken but that despite this there is a bigger component of the victim's female DNA on pad 2 than on pad 1. This quantitive element of the interpretation of the electropherograms was not taken into account by Colonel Otto. I find the reasoning that led to Dr Oosthuizen's conclusion that allele 22 at locus FGA is not present on the crime scene samples, convincing.

[32] For the reasons mentioned there is at the very least a reasonable doubt as to whether the STR profile of the appellant could be read into the STR profile of pads 1 and 2. In any event, even on the assumption that this could be done, there is no clear evidence on record as to the probability of that occurrence in the particular population. In addition the probabilities arising from the facts point strongly to the innocence of the appellant. As a result of the factual circumstances related above, the trial court appears to have found that the appellant raped the girl before she went to church with her mother on the day in question and that she was thereafter again raped by accused 2 and at least one other male. This is highly improbable, on the evidence of the mother of the child and on the general probabilities.

[33] It follows that the appellant should not have been convicted of rape and the appeal must therefore succeed.

[34] In the premises I make the following order:

1 The appeal is upheld.

2 The conviction and sentence are set aside.

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C H G VAN DER MERWE

ACTING JUDGE OF APPEAL

APPEARANCES:

For Appellant:	C B Brand
	Instructed by:
	Legal Aid Board, Cape Town
	Legal Aid Board, Bloemfontein
For Respondent:	M O Julius
	Instructed by:
	Director of Public Prosecutions, Cape Town
	Director of Public Prosecutions, Bloemfontein