

1: Critical reflections on the principle of beneficence in biomedicine

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This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license <http://creativecommons.org/licenses/by/4.0/>: This article has been cited by other articles in PMC. Native American forms of traditional healing have had, when compared with South African equivalents, a relatively long association within formal biomedical healthcare structures in the U. In South Africa, this has only been the case since the mids. While traditional forms of healing, both Native American and South African, are increasingly coming to be viewed as valuable by those operating within a biomedical mindset, both of these traditional systems are still largely understood to be secondary to biomedicine in their importance. Colonialism in both regions saw significant efforts by authorities to eradicate what they perceived to be practices based on superstition and irrationality and, although this binary perspective has now in some quarters been challenged, this has only become the case relatively recently. Native American healing practices were officially outlawed in the U. For the most part, biomedical hegemony has resulted in traditional healing being, at best, tolerated rather than embraced by those within the establishment. Policymakers are certainly now more open to the role that traditional healing can play as part of a broader approach to the practice of medicine, but the extent to which it can form an integral part of formalised healthcareâ€™based on its own meritsâ€™ continues to be much debated. Furthermore, despite and also sometimes even because of the efforts of countries like South Africa to offer a degree of equivalence for traditional forms of healing, it remains the case that biomedical and traditional perspectives are often presented as being competing and often incompatible systems. Health in Native American and South African Societies Healthcare indicators for Native Americans and black South Africans are significantly poorer than those of their white counterparts. For example, the difference in life expectancy between black and white South Africans is approximately 20 years [2]. Likewise, in the U. In both regions, poverty, inadequate nutrition, high levels of violent crime, alcohol and substance abuse, and poor access to healthcare are all contributing factors, many of which can be seen to stem from colonial legacies. In the case of South Africa, with a prevalence rate of Official statistics suggest that Native Americans are the third worst affected ethnic group in America, after African Americans and Hispanics. However, given the manner in which all people entered into the U. Furthermore, while prevalence rates are declining amongst other U. Evidence also shows that Native Americans infected with HIV have shorter life expectancies than those in other ethnic groups [6]. These, together with observer and other anthropological accounts offer a usefulâ€™and establishedâ€™body of material see for example [7 , 8 , 9 , 10 , 11 , 12 , 13 , 14] with which to contrast South African experiences. The IHS, too, is a repository for documentation detailing debates over policymaking and accommodation with respect to traditional forms of healing employed within formal healthcare structures <http://www.indianhealthservices.gov/>: Using the Native American literature and related IHS policy as an analytic framework and site of comparison, the argument put forward here draws on original fieldwork interviews conducted with South African and other African traditional healers and their clients, and addresses related policies enacted by the South African government. The traditional healers interviewed for this research can be categorized broadly as sangomas diviner-healers , as opposed to inyangas herbalists , or faith healers linked to the traditional African churches. The perspectives put forward by the healers consulted contribute significantly to the discussion below; their willingness to share their time and experience is gratefully acknowledged. The material was gathered during the course of a series of interviews conducted in that built on previous fieldwork conducted in The interviews were conducted in four locales across South Africa, incorporating both rural and urban environments and male and female respondents of varying age, social status and education level. The identities of all informants have been anonymised. These locations were selected in the interests of interrogating the pervasiveness of engagement with traditional healing in a range of environments. Grahamstown and Knysna represent, for the most part, similarly rural heartlands, still influenced heavily by traditional values. In order to achieve as broad a perspective as possible, interviews were conducted with both

healers and their patients and took the form of semi-structured informal interviews across individual and group sessions. While all of the traditional healers were of course working in South Africa, the nationalities of those consulted included Malawian, Tanzanian, Ugandan and Zimbabwean as well as South African. The traditional healer sample included both male and female practitioners of different levels of age, experience and standing in the community including apprentice healers and their mentors. The paper also draws on secondary anthropological studies focusing on traditional forms of South African healing [15 , 16 , 17 , 18 , 19 , 20]. Locating Contemporary Traditional Healing South African and Native American traditional forms of healing are both deeply embedded and have a broad resonance that in many respects transcends the ethnic and cultural boundaries of each region. For example, while there are an estimated 4. Claims that Native American healing has been practiced for 12, years or longer, depending on when the Americas were first inhabited , intentionally or not cement this perspective [24]. It is accepted that the cataclysm wrought by infectious diseases introduced to the Americas after impacted dramatically upon the social and cultural fabric of Native American societies. Depopulation estimates range between 78 and 97 percent of the pre-Columbian population of North America [24] pp. By the late nineteenth century only approximately , Native Americans remained out of a pre population that may have been as high as 18 million [24] p. By extension, this undermines severely any argument that twenty-first century Native American traditions represent 12, years of continuity. The origins of pre-colonial South African forms of healing are similarly clouded. However, while generally conservative and rooted in the past, the traditional healing practiced today in both regions has not gone unchanged over the centuries. All systems evolve and traditional healing is no different in this respect. Colonialism engendered additional complications; knowledge and traditions have eroded in the face of centuries of instability and conflict to the point that it is difficult to say with any certainty that what is practised currently would have been recognisable to pre-colonial societies. The twentieth-century evolution of the peyote religion into what is now the Native American Church is an illustration of the potential for shifts and changes within traditional systems: In terms of basic observances for example, peyote ceremonies usually take place in tipis even though such structures were not traditionally employed by groups of significant size like the Navajo [14]. The sweat lodge too, long viewed as a universal symbol of Native American healing and one embraced by New Age healers , and now also incorporated as a ceremony within the Native American church, was not historically utilised by all groups. Traditional South African forms of healing have similarly seen changes, particularly in urban areas. The list of industrial ingredients found in many traditional remedies would, of course, have been wholly unknown in pre-colonial societies [27 , 28]. Engagement with healers from other parts of Africa also represents an evolution of traditional perspectives [29]. Roots aside, contemporary traditional healing forms an important aspect of Native American and South African perspectives on healthcare. This figure was also employed with specific respect to South Africa in the South African Medical Journal in [32]. In South Africa, the more considered evidence suggests a far lower but nonetheless significant proportion of adherents [34]. Similarly, with respect to Native Americans, figures for those making use of traditional healing range between 38 and 70 percent [35] p. Science and the Supernatural: While much of the discourse in medical anthropology and medical sociology prior to the s saw a clear separation between what were perceived to be very different approaches to sickness, Bradley Stoner has shown that, globally, the division is less precisely delineated [36 , 37]. As Stoner has also demonstrated, what people want, with respect to healthcare, are options, irrespective of how these may be defined. Evidence from both regions suggests that the vast majority of users engage in some form of medical pluralism. Most South African and Native American traditional healers are comfortable in both distinguishing between traditional and non-traditional sicknesses, and accepting that aspects at least of the latter are best treated through recourse to biomedicine. It is also clear that Native American traditional healers themselves see nothing problematic with engaging personally with biomedicine when necessaryâ€”Conley [10], Mohatt [13] and Langley [14] all record conversations with healers freshly discharged from their local hospitals. Until recently, analysts saw the lines dividing the two systems as being fairly clear cut and at odds with each other , especially on matters involving the supernatural. Most biomedical hospitals have chaplains of various faiths attached and prayer is employed regularly by users of biomedical institutions as a complement to treatment a survey suggests that up to 70 percent of Americans

believe that prayer can help to cure sickness [40] p. Moreover, although attempting to quantify the impact of prayer on those who are sick is methodologically controversial, evidence from a small number of randomised tests suggests that it may be possible to identify a positive effect. A study focusing on coronary patients in the U. Such evidence is, however, far from conclusive. Scientists and biomedical practitioners continue to debate hotly the extent to which the impact of prayer can be studied objectively. Be that as it may, it can be taken that many patients and practitioners within the biomedical system believe in the power of supernatural intercession [43]. Critically, as an extension, the majority of patients also see no conflict in requesting supernatural intercession whilst being treated within a healthcare framework that offers no ontological space for the supernatural. Biomedical and Traditional Perspectives: Native American and South African forms of healing should not be understood as nascent forms of biomedicine that, given time and space, will evolve into something akin to the western model. Rather, these examples of traditional healing form alternative systems of healthcare. In both instances, unlike in the pathology-focussed biomedical model, traditional forms of healing rely heavily on aspects of the supernatural with respect to both diagnosis and treatment [29 , 44]. For example, traditional healers from both traditions are generally called to the profession at a young age through dreams and visions [10 , 11 , 29 , 45]. Malevolent intent on the part of others, on the other hand, involves witchcraft: In both traditions it is witchcraft that is understood to play an often central role in the causation of illness. As a result, illness is rarely viewed as transmittable; witchcraft is nearly always person- or, occasionally, family- specific [10 , 14 , 29]. The invoking of witchcraft, as perceived across both cultures, generally originates out of jealousy and a desire to see a successful person brought low. As a number of informants contributing to this study detailed, bad luck is, essentially, no matter of chance; both good and bad fortune are shaped by the supernatural [29]. Resolution of bad fortune, therefore, is also understood to require supernatural intervention, usually invoked through ceremonies and rituals. Medication, if required, is determined on the basis of supernatural direction rather than pharmaceutical benefit—for example, the smoking of blessed cigarettes is a common prescription within Native American healing [11 , 47]. More recently, that clinical trials have found few traditional medicines to impact positively on pathogens has served to corroborate this earlier perspective. However, attempts by both policymakers and the biomedical community to codify what is and what is not traditional healing reveals a fundamental misunderstanding of what it is and how it is practiced. For example, the idea of charlatan healers sits uncomfortably within both cultures—in general, failure to find a cure is often viewed as an indication not of fraudulence or misdiagnosis on the part of the traditional healer, but rather of the strength of the supernatural forces aligned against the patient. In such cases, it thus becomes a matter of seeking out a more powerful healer. A healer demanding payment upfront may sometimes be deemed suspect [29]. The gulf between biomedical and traditional cosmologies is undeniably wide, as are the respective approaches to diagnosis, patient care, and treatment; double-blind testing and laboratory-based demonstrations of efficacy are inadequate tools for validating diagnoses acquired through communication with the spirit world. Curing is, in essence, a largely biological process that results in the removal of disease from the body. Illness is viewed generally as a more psychosocial condition involving spiritual or mental health aspects in need of healing for a more detailed discussion see [49]. While the utility of this dichotomy is much debated, it tends to be the case that biomedicine is focused on the curing of disease while traditional healing is inclined to be more concerned with illness. In basic terms, the two systems are not necessarily attempting to achieve the same goals or outcomes, which can be confusing to outsiders, particularly given that the language used to describe both processes is often seemingly interchangeable. In part this is due to the fact that the lexicons of traditional cosmologies often translate poorly into English and other European languages , resulting in the obscuring of major epistemological divides. When traditional approaches are described in English terms, with the biomedical associations of the latter, it can create illusions—if not aspirations—of equivalence: They routinely receive their patients in offices, with waiting rooms staffed by receptionists, in much the same way as biomedical general practitioners would. The Advantages of Traditional Healing for Patients Mehl-Madrona describes how, during his biomedical training, management demanded that he see at least three patients per hour [11]. This is by no means unusual within biomedicine; doctor-patient interaction is generally kept to a minimum. The resultant feelings of alienation

and frustration experienced by patients under these circumstances can be exacerbated when practitioners are unable to engage patients in their own languages. Traditional healers, on the other hand, tend to spend a great deal of time with their patients, with some Native American ceremonies extending across a number of days [10 , 12 , 14]. Some intensive therapies have been known to involve daily contact between healer and patient for over a month [13]. In fact, what stands out when comparing the two systems, is that traditional healing, unlike that of biomedicine, is often communal rather than private.

2: SAGE Reference - Biomedicine, African Americans and

The African Journal of biomedical Research was founded in as a joint project between a private communications outfit (Laytal Communications) and members of the Ivory tower.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. This article has been cited by other articles in PMC. Abstract Medical ethics as a scholarly discipline and a system of moral principles that apply values and judgments to the practice of medicine encompasses its practical application in clinical settings as well as work on its history, philosophy, theology, anthropology and sociology. As such there are a number of values in medical ethics such as autonomy, non-maleficence, confidentiality, dignity, honesty, justice and beneficence, among others. These values act as guidelines for professionals in the medical fraternity and are therefore used to judge different cases in the fraternity. For purposes of this work, this paper examines the principle of beneficence in biomedicine. Using both hypothetical cases and others in real life situations, the paper reflects on the implications of beneficence in biomedicine. Beneficence, principle, reflections, medical ethics, biomedicine Introduction Although ethicists have long since discussed values in medical ethics in general, and in particular beneficence, I wish to take issue with it. This is because, in my view, ethicists have not gone far enough in analyzing beneficence, and we still have some way to go towards a comprehensive and systematic approach to the subject beneficence , especially in terms of its implications and applications to some issues of biomedicine. In this paper, my argument will proceed in four steps. First, I will shed light on the general understanding of the beneficence as a principle of medical ethics. Second, I will underscore the complexities of beneficence in biomedicine; third, I will consider using case s , the implications of the principle of beneficence in biomedicine. Finally, I will discuss strategies or possible ways that medical professionals can use the principle of beneficence to benefit both the general public and preserve the integrity of the medical fraternity itself. Understanding the nature of the principle of beneficence The concept of beneficence though widely used in medicine is difficult to define with precision. As such, a number of interpretations have been conjured. Though traditionally, acts of beneficence are oftenly done from obligation, the principle is suggestive of altruism, humanity, unconditional love and non-obligatory optional moral ideals. More commonly in medical ethics, beneficence is understood as a principle requiring that physicians provide, and to the best of their ability, positive benefits such as good health, prevent and remove harmful conditions from patients. This is to say that beneficence as a principle of medical ethics asserts an obligation on the part of the physician to help others patients further their important and legitimate interests and abstain from injuring them in any way, that is, psychologically, morally or physically. From the foregoing, it can be noted that the central question for beneficence within the patient-physician relationship is: This has its earliest expression or its primary historical sources in ancient Greece and the Hippocratic Oath which characterizes physicians as a group of committed men as women were excluded from medicine in the Greek society set apart from and above others in the society. The central values of the classical Hippocratic ethics were non-maleficence doing no harm , beneficence and confidentiality. In the modern era, the Hippocratic Oath is traceable to the 18th century with John Gregory and after World War II, medical ethics started to advocate patient autonomy in the guise of informed consent. However, over the last 20 years, there has been growing dissatisfaction with the individual rights-centered ethical framework [7]. The complexities of beneficence in biomedicine As has been seen on the nature of the principle of beneficence explicated above, the obligation to confer benefits and actively prevent and remove harms from patients is important in biomedical ethics. This makes it important to distinguish two principles under the general principle of beneficence-the principle of positive beneficence and the principle of utility [8]. The first principle is known as the principle of positive beneficence. This principle requires the provision of benefits including the prevention and removal of harm from others i. It also includes the promotion of welfare of others. The second version is the principle of utility. This principle, unlike the first, requires weighing and balancing benefits and harms in moral life. This is to say that utility as a principle of beneficence in

biomedical ethics makes it imperative for physicians and other health workers to carefully analyze, evaluate and promote those actions that bring more benefits to others i. The second version makes it clear that the principle of beneficence is a prima facie moral obligation. In the real life situation, we must balance the demands of these principles by determining which carries more weight in the particular case. This means that the principle of beneficence is not absolute as it is not always binding. Yet this is where the complexity of the principle of beneficence begins in biomedicine. If the principle of beneficence is not absolute in biomedicine, it means that beneficence in biomedicine is not only restricted in application to the patient-physician relationship. It also extends to third parties to that relationship in so far as third parties to the patient-physician relationship can be affected, positively or otherwise. To make this clearer, let us consider the following situation: The husband P is HIV positive, but for fear of revealing this information to his wife who is negative and pregnant decides to conceal this information to her. Instead, H sought to arrange a family medical Doctor who helps him with medication to prolong his life. This situation puts the Doctor in a very difficult position especially considering the right of patient to confidentiality. However, the principle of beneficence should be given priority over the principle of respect for patient confidentiality; we need to move beyond individual rights to common good. This is echoed by Margit Sutrop [7] who argues that defense of autonomy and privacy has become an obstacle not only to the use of data in scientific research but also to the use of such information in the implementation of social goals. Thus coming back to the example given above, respecting third parties will be more desirable. In fact since the principle of beneficence is prima facie the second version of the principle-the principle of utility-would require that the third part, W be informed so that she and the foetus are not harmed not infected as well. Thus in this case, the principle to save more lives of W and the foetus is stronger than the right to confidentiality of H. Yet it should be noted and emphasized that the principle of beneficence is always associated with a number of implications especially when used in issues of biomedicine. The Implications of beneficence in biomedicine From the exposition of the nature and complexities of beneficence in the previous sections, it is sufficient to infer that the principle has a number of implications. As previously highlighted, the first principle under the general principle of beneficence-positive beneficence-imply beneficence even to third parties. Put it in other words, since the moral life does not permit us simply to produce benefits without creating risks, positive beneficence would imply that even the third parties to the relationship between the physician and the patient should be benefited. This, however, often creates ethical quandaries-moral dilemmas difficult to solve. One neat case is the example I have given in the previous section, that of a family medical Doctor who happens to know that one of the partners of his clients, H is HIV positive. Second, the principle of utility under the general principle of beneficence implies that the interests of the society as a whole should override the individual interests and rights [3]. In the light of this analysis, the unconstrained principle would allow, for instance, a bone marrow transplant, which has the possibility of risks of the donor becoming a cripple or even dying, to be undertaken from a societal member to benefit a democratic president of a Republic who is suffering from an end-stage organ failure. This is echoed by Gallup Survey who argues that the general principle of beneficence especially that with a version of the principle of utility implies that premature or hastened death of individual donors of cadaver organs done in order to benefit patients is justified [9]. Thus for Survey, the principle of utility shows that the principle would justify hastening death of one patient in order to benefit say five others who would procure a heart, a kidney, a liver, an eye and bone marrow each. This situation that beneficence implies is very problematic. It shows that the principle is prone to abuse. As a matter of consequence, unconstrained principle of beneficence generates a sense of distrust and fear for abuse in donors of cadaver organs as they would always worry that physicians might declare them dead prematurely in order to benefit other patients. Another implication of beneficence has been cited by Peter Singer. He applies the principle in situations such as poverty. Put it differently, positive beneficence implies that we are morally obligated to make large sacrifices and substantially reduce our standard of living in an effort to rescue destitute or poor people around the world. The rich for example would be obliged to reduce their wealth to approximately the level of the poorest person in the world. Thus, though the principle of beneficence is important some of the implications that arise especially in the medical fraternity and other spheres as a result of its presence makes it problematic such that its use and

application should be done with caution. The next section makes a critical look at how the principle of beneficence should be applied in biomedicine. How to apply the principle of beneficence in biomedicine? The way forward It is a truism that it is hard enough to resolve rationally the moral questions that arise in many cases of biomedicine. To this kind of thinking, I disagree. This is because in my view, moral curiosity and quest for understanding the good and the bad, the right and the wrong are a worthy and even sometimes a noble human characteristic. This is echoed by David Hume who correctly observed that: This exercise of making judgment is the beginning of moral reasoning that extends into all spheres of life, biomedicine included. Though acknowledging that the application of beneficence in most of the issues of biomedicine arguably cause consternation between professionals, patients and members of the public, this does not mean that we should not make judgment of the issues. This is because making judgments and shedding light through critical questioning on medical issues help professionals in the medical fraternity to deliberate with ease on some of the difficult issues of biomedicine. For this reason, I argue that the principle of beneficence is a prima facie obligation that should always be acted upon unless it conflicts on a particular occasion with an equal or stronger principle. This entails that the principle should not be universally applied at all times to all cases of biomedicine. However, like many other principles of medical ethics, beneficence, especially because of its implications, being a prima facie obligation and the complexities around it, should not always be applied in a universal manner to all cases of biomedicine. Given this scenario, medical professionals often find themselves in a catch twenty-two situation to the extent that it becomes difficult for them to deliberate on many of biomedicine where beneficence is involved. From this observation, it has been argued that there is need by academics and medical professionals, among others, to keep on reflecting on the principles of medical ethics such as beneficence to determine their applicability to different cases that arise in biomedicine. More importantly, it has been emphasized that although the principle of beneficence is complex and with some far reaching implications, its importance in biomedicine should not be underestimated. The merit of this study therefore lies in its quest to see to it that practitioners in biomedicine recognize the controversies around such principles as beneficence and collaborate with other parties to deliberate on biomedical issues in ways that uphold the ethical integrity of the medical fraternity and illuminate understanding of their practices.

Competing interests The author declares no competing interests. Accessed 10 September The moral responsibilities of physicians. The moral responsibilities of physicians; p. Principles of biomedical ethics. Oxford University Press; Cross cultural perspectives in medical ethics. J and Burlett Publishers: How to avoid a dichotomy between autonomy and beneficence: Journal of Contemporary Health Law and Policy. Cambridge University Press; Runzheimer J, Larsen LJ. Reviewing Ethics and Common Controversies in Medicine.

3: Biomedicine - Wikipedia

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VALUES.

4: African Journal of Biomedical Research

The question we attempt to answer in this article is this: How do Christian healers in sub-Saharan Africa perceive biomedicine? To address this, we draw on field research carried out in Abidjan, the major city of CÔte d'Ivoire. 4 In terms of methodology, the approach is qualitative. The data was collected through interviews that were administered to 72 Christian practitioners involved in therapeutic activities.

Medical biology [7] is the cornerstone of modern health care and laboratory diagnostics. It concerns a wide range of scientific and technological approaches: Medical biology is based on molecular biology and combines all issues of developing molecular medicine [12] into large-scale structural and functional relationships of the human genome , transcriptome , proteome , physiome and metabolome with the particular point of view of devising new technologies for prediction, diagnosis and therapy [13] Biomedicine involves the study of patho - physiological processes with methods from biology and physiology. Approaches range from understanding molecular interactions to the study of the consequences at the in vivo level. These processes are studied with the particular point of view of devising new strategies for diagnosis and therapy. Through an anthropological lens biomedicine extends beyond the realm of biology and scientific facts; it is a socio-cultural system which collectively represents reality. Molecular biology consists of different techniques including Polymerase chain reaction, Gel electrophoresis, and macromolecule blotting to manipulate DNA. Polymerase chain reaction is done by placing a mixture of the desired DNA, DNA polymerase , primers , and nucleotide bases into a machine. The machine heats up and cools down at various temperatures to break the hydrogen bonds binding the DNA and allows the nucleotide bases to be added onto the two DNA templates after it has been separated. This process is done by first preparing an agarose gel. This jelly-like sheet will have wells for DNA to be poured into. An electric current is applied so that the DNA, which is negatively charged due to its phosphate groups is attracted to the positive electrode. An alkaline solution is prepared in a container. A sponge is placed into the solution and an agarose gel is placed on top of the sponge. Next, nitrocellulose paper is placed on top of the agarose gel and a paper towels are added on top of the nitrocellulose paper to apply pressure. The alkaline solution is drawn upwards towards the paper towel. During this process, the DNA denatures in the alkaline solution and is carried upwards to the nitrocellulose paper. The paper is then placed into a plastic bag and filled with a solution full of the DNA fragments, called the probe, found in the desired sample of DNA. The probes anneal to the complementary DNA of the bands already found on the nitrocellulose sample. Afterwards, probes are washed off and the only ones present are the ones that have annealed to complementary DNA on the paper. Next the paper is stuck onto an x ray film. The radioactivity of the probes creates black bands on the film, called an autoradiograph. As a result, only similar patterns of DNA to that of the probe are present on the film. The overall process results in a precise reading of similarities in both similar and different DNA sample. Living organisms need essential elements to survive, consisting of carbon, hydrogen, nitrogen, oxygen, calcium, and phosphorus. These elements make up the four big macromolecules that living organisms need to survive- carbohydrates, lipids, proteins, and nucleic acids. The simplest one of carbohydrates is glucose , $C_6H_{12}O_6$, is used in cellular respiration to produce ATP, adenosine triphosphate , which supplies cells with energy. Proteins can facilitate biochemical processes, by lowering the activation energy of a reaction. Hemoglobins are also proteins, that carry oxygen to the cells in an organisms body. Due to their unique structure, lipids provide more than twice the amount of energy that carbohydrates do. Lipids can be used as insulation, as it is present below the layer of skin in living organisms. Moreover, lipids can be used in hormone production to maintain a healthy hormonal balance and provide structure to your cell walls. DNA is the main genetic information storing substance found oftentimes in the nucleus, which controls the processes that the cell undergoes. DNA consists of two complimentary antiparallel strands consisting varying patterns of nucleotides.

5: SA Biomedical | Home

A brief recap of the intense one-week Design School! Surfing on the UBORA website you can find also the teaching resources: slides and example files just clicking on the name of classes and workshops.

6: The PAMJ – Unleashing African Biomedical research

The Pan African Center for Public Health Research and Information (www.enganchecubano.com) is a non-government organization registered with the Kenya NGOs Board. We promote the dissemination of biomedical research done in Africa.

7: Division of Biomedical Engineering

SAGE Video Bringing teaching, learning and research to life. SAGE Books The ultimate social sciences digital library. SAGE Reference The complete guide for your research journey.

8: South African Companies Related to Biomedical Engineering | Division of Biomedical Engineering

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9: Non-NIH Funding Opportunities - Grants and Fellowships - Fogarty International Center @ NIH

The list below provides details of companies in South Africa that are related to biomedical engineering, medical devices, healthcare technologies and similar. Please also check the South African Medical Device Industry Association (SAMEDI) and Medical Device Manufacturers South Africa (MDMSA).

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