The potential of DNA structure to provide a resource for the creation of art

Abstract

Art’s search for new subjects and methods and science’s need for effective communication have led to the creation of what is known as Sci-Art. It is the central argument of this thesis that collaboration between creative and scientific disciplines can play a useful role in society, but that this potential is held back by misunderstanding of the roles of art and science. The main purpose of this practice-based research project, which is also supported by a written thesis, is to determine the relationship between artists and scientists, focusing on the visualisation of DNA. The project will identify their shared approaches to its representation, and will explore the history of DNA as an iconic form. An additional purpose of this study is to analyse the importance of the role of collaboration between scientists and artists including its application to education. My method is to review Sci-Art work and analyze the benefit of collaboration between science and art. Part of this research will focus on the benefits of Sci-Art collaboration for education. This part of the research involved a case study at Trinity Catholic School, with a project called Laboratories. Collaborative artworks and exhibitions are the final outcome of this project; they explore the ways in which Sci-Art can be developed as a useful form of interdisciplinary practice. These creative methods provide a route to a deeper understanding of the relationship between art and science. The thesis demonstrates through a combination of theoretical argument and creative practice that Sci-Art has the potential to: Act as an aid to understanding difficult scientific concepts; add to debate about the ethical issues surrounding science and increase the effectiveness of education.

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The Structure of DNA. Nucleic acids are made up of chains of many repeating units called nucleotides (see bottom left of Figure 1 below). The DNA molecule actually consists of two such chains that spiral around an imaginary axis to form a double helix (spiral.) Nucleic acid molecules are incredibly complex, containing the code that guarantees the accurate ordering of the 20 amino acids in all proteins made by living cells. Surprisingly though there are only a few different nucleotides: only four different nucleotide units comprise DNA, the nucleic acid of interest to the genealogist. This process holds much promise for the creation of new materials. DNA is a robust functional entity that can organize itself and other molecules into complex structures. More recently DNA has been used to organize inorganic matter, such as metallic particles, as well. DNA molecules provide what is probably the most iconic example of self-replication—the ability of a system to replicate, or make copies of, itself. In living cells the process is mediated by enzymes and occurs autonomously, with the number of replicas increasing exponentially over time without the need for external manipulation. DNA tiles The researchers used artificial structures of DNA – so-called DNA tiles – dissolved in water to demonstrate the new process. DNA provides an intelligent route for the creation of nanoarchitectures with programmable and predictable patterns. DNA strands twist along one helix for a number of bases before switching to the other helix by passing through a crossover junction. DNA-modifying enzymes can also be used to generate and manipulate DNA nanostructures. Although studies in this area have so far been limited, many design tools have been developed for the application of these enzymes to alter DNA in a sequence-specific manner. Most of these enzymes work like small nanofactories and are, hence, highly specific in their actions, based on various biological processes [13].