AUTOMATED BALL LAUNCHER FOR ALLEVIATION OF PET CANINE SEPARATION ANXIETY

THE FUTURE OF TUMOR REVERSION THERAPY: HOW SOCIETY DECIDES THE INTERPRETATION OF A TECHNOLOGY

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By

Alexander Byrd

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It is important to draw wisdom from different places; if you take it from only one place it stagnates. The electrical and computer engineering technical project draws from mechanical engineering and material sciences to develop an automated ball launcher to address a psychological problem experienced by dogs. The STS report explores how different technologies may all contribute to a theoretical form of cancer treatment. Both the technical project and STS report in this portfolio demonstrate the importance of incorporating other fields of study with electrical engineering to achieve feats that neither field could reasonably accomplish in isolation.

The automated ball launcher was developed primarily to expand the skills of the capstone team with interdisciplinary electrical engineering applications. The automated ball launcher was also intended to help treat the mental health of dogs but training a dog to use it was beyond the scope of the semester long project. However, if the project were continued a metric for mental wellbeing of the dog would have been qualitatively comparing its behavior when playing fetch with a person rather than with the ball launcher. The goal within the scope of the semester was producing an automated ball launcher capable of launching a ball a specified distance, rotating to a specified angle, and wirelessly communicating with a web service to program the automated process.

The automated ball launcher was completed and successfully launched the ball within the team's specified parameters. The team had very little prior experience with motors and 3D printing before undertaking the project, so incorporating them into the project provided the team with valuable insights. Supply chain issues significantly delayed the construction of the automated ball launcher, so improvisation was required to assemble the ball launcher out of the available parts rather than the ideal parts. Valuable skills in cataloging electronic parts were developed as the supply chain also did not allow for many mistakes in part selection. The team

proved their ability to learn new fields while also applying their expertise to adapt to changing circumstances.

The STS report analyzes and compare three ongoing areas of research that have the potential to facilitate the theoretical reversion of tumors into healthy tissue: the replication of the embryonic microenvironment, creative utilization of gene editing, and the manipulation of morphogenetic signals with electroceuticals. The STS thesis is organized to explore the relationship between various social factors and the development of tumor reversion therapy through the framework of Social Construction of Technology, which was defined by Bijker et al. in 1987 and revised by Klein and Kleinman in 2001. The impact society has on each of the research areas will be analyzed through the framework of the Social Construction of Technology to answer the following question: How do the interests of the scientific and medical communities, as well as the regulatory and ethical concerns of society, influence which developing technology will be utilized in the first clinically approved tumor reversion therapy?

Each developing technology was found to have a different trajectory regarding the cancer treatment. Enveloping tumors in embryonic-like microenvironments appears to be the most unlikely method to produce the first tumor reversion therapy; it has the least funding and recent media coverage of the three technologies, and its most prominent research teams are limited by cultural or religious concerns regarding experimentation with human embryos in the countries they are based. The gene editing tool CRISPR has the most public attention, but ethical concerns regarding its potential for eugenics or bioweapons, ongoing legal battles over patent rights, and the high demand in other medical applications distracts from its development towards developing cancer treatments. Morphogenetic manipulation using electroceuticals has the most support from the medical communities due to its many applications in regenerative medicine, many of the

drugs considered electroceuticals are already approved for use in humans, and the controversial applications of the technology in developing synthetic lifeforms have surprisingly increased its funding from governments and private businesses hoping to develop bio-computers. However, the regular administration of the correct electroceuticals, in the correct places, and in the correct doses to revert tumors would require either long term hospitalization or a significant degree of patient participation, both of which are difficult to find. Realistically, research into embryonic microenvironments is needed to know which electroceuticals to use and where, and nanobots or CRSPR-produced biological agents are needed to administer the electroceuticals in regular intervals over long periods of time to produce the morphogenetic code necessary to revert a tumor.

The technical project illustrated the strength provided by using more than one source of knowledge. Each technology in the STS report has the potential to provide the tumor reversion therapy on its own, but it is more likely that a combination of them will produce one before any individual field does. The ability of an engineer is reflected in their ability to adapt to new information and incorporate it into their existing repertoire.

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