***Gene Manipulation through Engineering***

Scientist have been studying the role of genes over decades. Those previous studies have helped scientists to be able to identify which genes were in charge of which traits and responses, for example, MC1 (melatonin receptor 1) is the gene that expresses eye color1. Furthermore researchers found that biological and environmental factors played a key role in activation of certain genes2. What types of cellular structures create a gene or how hot/cold the surrounding environment is to a gene will allow for certain functions to happen or not to happen. These conclusions helped create synthetic biological circuits. Synthetic biological circuits are the future in having electronic control over the body’s biological functions2.

Synthetic biology circuits are making waves by breaking down, replicating and replacing natural cellular functions. Engineers have created systems, much like the ones found in computers, which organize internal cellular data and prompt commands that can control how cells work. In computers, the system can organize data through inputs such as the keyboard and mouse, which prompt for control over the output, like how your sales activity report will appear. In synthetic biology circuits, the system recognizes a specific part of DNA that is responsible for a specific function. The synthetic circuit then creates a new code based on algorithms, the input, to be transferred into the cell and replace the original code, thus producing a new function or new output1. Computers have more components to assist with each function, like the hard-drive, software and central processing units. Likewise, synthetic biological networks do too. The networks mimic those of natural cellular networks, for example that of the immune system. The immune system contains T cells, B cells, compliment and antibodies to complete the function of innate bodily defense against a pathogen. A synthetic network could essentially replace the current code for one’s natural defense with the DNA sequencing of a different defense in order to gain a favorable defense response. If the immune defense is not the network a scientist needs to manipulate then the synthetic biological circuit can be altered to focus on a different system and obtain a desired function through changes of the inputs.

The ability to control innate processes could allow for scientists and medical professionals to have more treatment options through the creation of new medications and vaccines. It could help contain diseases through manipulation of one’s internal cells or that of organism causing the disease. Recently conducted research used a synthetic biology circuit with an oncolytic adenovirus- a virus that typically leads to cancerous tumors to test the function of the adenovirus if it were to be manipulated. After the virus was manipulated or genetically modified, it was then placed into cells, using the synthetic system, where it then functioned as a tumor-cell killer rather than a tumor-causing agent3. While this seems promising, the research on the use of synthetic biological networks is very time consuming and limits the research altogether. Simply gathering data for one input like the DNA sequence of a desired function, along with all the internal cellular structures involved in creating that function, is a tedious task. However, if more research can be conducted, then more known sequences and functions will be recorded for ease of future use. Until then, the reliability and validity of the biological synthesized circuits are considered low.

**References**

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