Honors 177

MIDTERM

OncoProbe

Portable Cancer Diagnostic Tool On-the-Go

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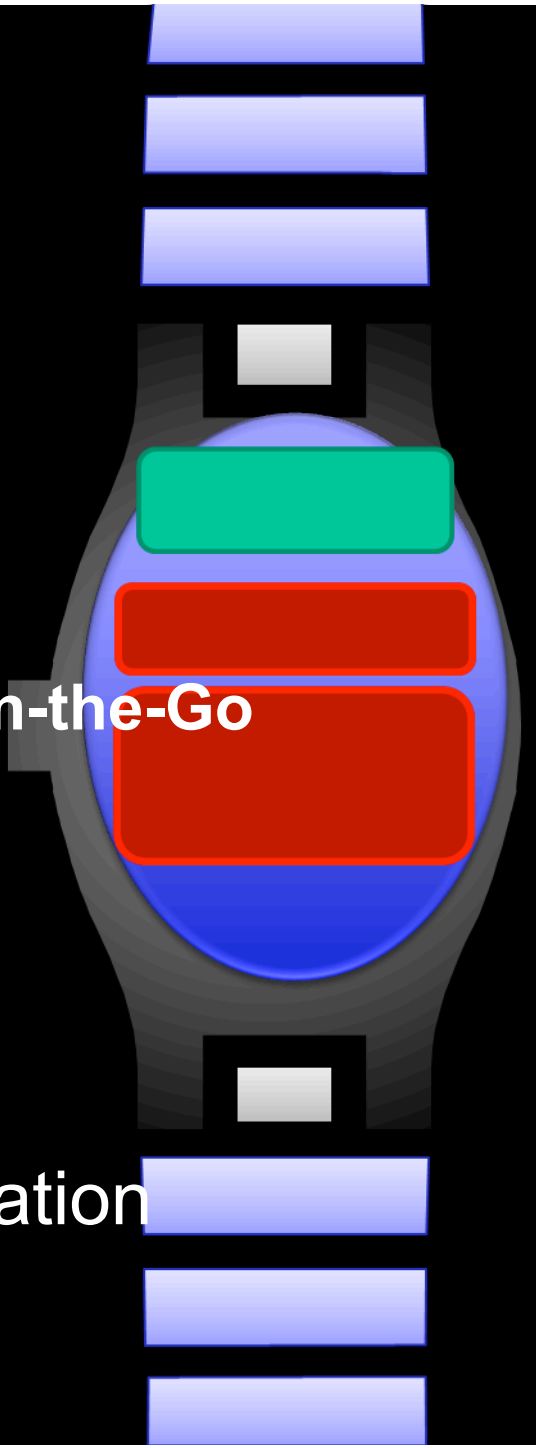
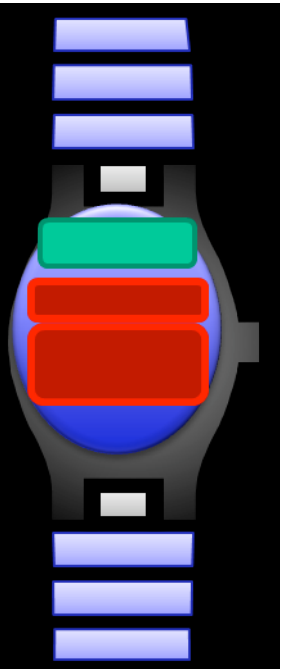
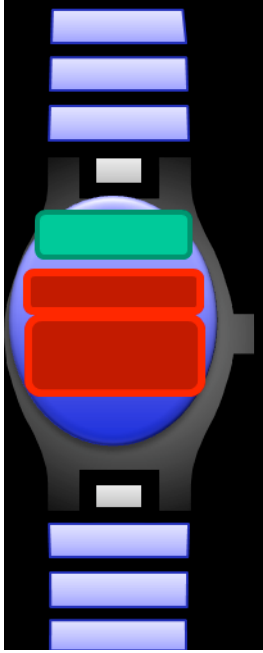


ABSTRACT

Current advances in stem cell biology in the last two years have opened up doors of opportunities for patient-specific treatment of cancer. The OncoProbe serves that very purpose. By merging current technological advances in research frontiers of stem cell biology, recombinant DNA technology (i.e. genetic engineering), nanotechnology, and bioengineering, the OncoProbe allows users for cancer diagnostic without the need to leave the comforts of their home. Through the use of genetic engineering and digital art, users will have full access to information about their disease, all located on a fashionable digital wristwatch.





CONCEPT / TOPIC

Genetic engineering is a hot field that is rapidly evolving: from the use of GM foods in the public market to animal transgenics. Although stem cell biology have been accelerating faster than the speed of light, its potential is not really made accessible to the public. In this proposed project, I hope to combine both genetic engineering and stem cell biology to provide a therapeutic diagnostic tool serving two purposes. First, it provides a ease-of-access tool for users to diagnose themselves of either abnormal health (i.e. high blood pressure, insulin levels), or identified cancer types. Second, this tool would educate users about their underlying health problems as well as the benefits of stem cell research for cancer therapeutics.

CONTEXT & PRECEDENTS

The ‘holy grail’ of stem cell biology is to allow for patient-specific treatment. In order to reach that goal, the public needs to be aware of the great therapeutic potential of stem cells, not just from embryonic stem cells but from other sources as well.

Recently, scientists have been able to induce human skin cells back to pluripotent stem cells through the use of transgenics called “iPS”. This can generate many cell types including neurons, muscle cells, blood cells, liver cells, etc. Scientific research has provided much optimism for the use of iPS for therapy.

Despite the advances in stem cell research, there has not been many attempts to educate the public regarding the matter. Since this area is still in fruition, artists have not tried to convey the idea of “using ones’ cells to cure oneself”. This emerging concept needs to be further accepted by the general public.

PROJECT PROPOSAL

The OncoProbe has one main function: to allow users to detect known cancer types. Its full functionality is not limited to detection, nonetheless. Once the cancer type is detected, the user will have the option to send the information to the research institution and develop an individualized treatment. This will be discussed later.

Each OncoProbe has a unique ID associated with the user's health profile including sequenced genome, weight, height, calculated BMI, blood pressure, sugar/cholesterol levels, etc. This unique ID gives the user confidentiality control when information is sent wirelessly to public research institutions and hospitals. Also, the OncoProbe is solar powered so there is no need to change batteries and it does not rely on electrical power, very environmentally friendly!

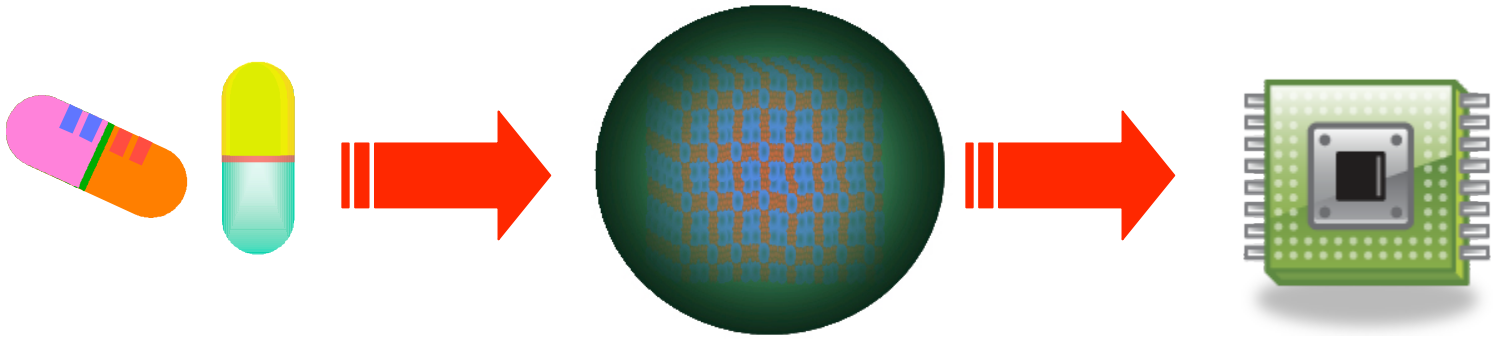
There are three options: **Profile, Q-Scan**, or **OncoProbe**. To view their health status, users can click on **Profile**.

Project Proposal (cont.)

Under the **Profile** submenu, information regarding the health status of the user is displayed in great detail, including cholesterol levels (total, HDL, and LDL, Triglycerides). The OncoProbe also has a nanosensor that can detect the user's health information automatically. Users can select **Q-Scan** to check their health real-time. This great functionality gives the user complete control over when and where perform a health diagnosis without an appointment with their primary care physician.

Another feature of the OncoProbe is to allow the user to understand what each of the numbers in the health status mean. By clicking on **[?]**, users will have access to information regarding their health status, what are acceptable ranges, and online sources available real-time in this portable device. Not only does this provide a great health diagnostic tool, it also educates the user and motivates them to learn more about their health.

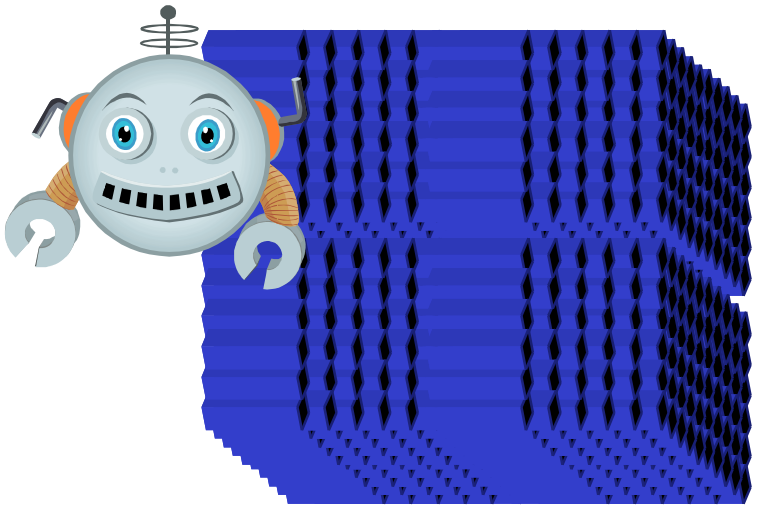
Project Proposal (cont.)

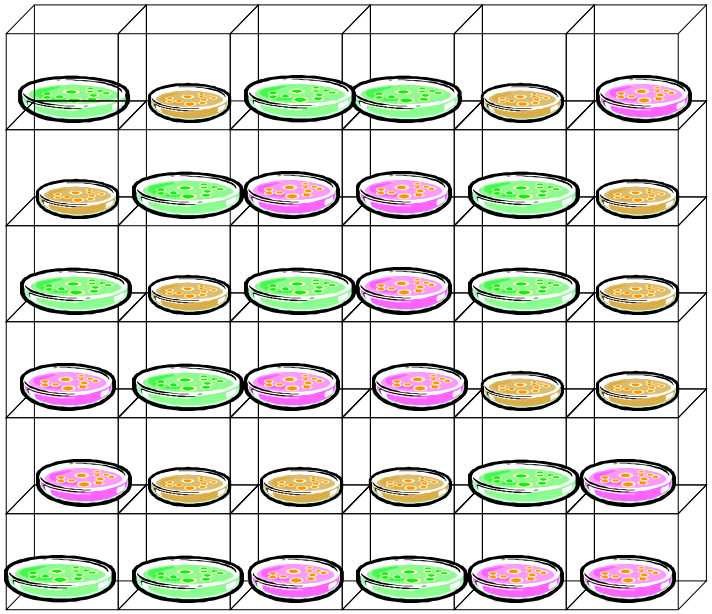


The OncoProbe is a cancer diagnostic tool, containing a full library of known proteins that are abnormally high in different types of cancer cells. This library is stored inside a biodegradable quantum chip, that is virtually wired to the OncoProbe. This pill, called NanEdible is unique in that the dosage is dependent upon the user's health, such as body mass index (BMI), height, insulin levels, etc. The NanEdible is synthesized from superparamagnetic nanoparticles (SPIOs), made of iron oxides and coated by a layer of lipids, trapped inside a vesicle. This ensures that the content of probe does not reach the human body. Once inside the body, it gets taken up by the cells. If it does detect high levels proteins of any known cancer types, an electrical signal is sent to the OncoProbe and stored in a virtual SQL database. The NanEdible is completely safe, as it will send signals to phagocytes in the body to take it up after 20 minutes.

After 24 hours, when the user click on DETECT, the device will notify the user of the cancer type detected. The user has the option to send this information virtually to their primary care physician and participating research facilities.

Project Proposal (cont.)





Upon receiving a positive cancer detection report from the OncoProbe, the participating research facility will retrieve the harvested skin culture initially collected by the user. These harvested cultures are maintained by pre-programmed robots and individualized cultures are identified by ID# and computer-generated serial numbers.

The individualized treatment consists of culturing skins cells from the user, harvesting and growing them in the laboratory, and changing it back to pluripotent stem cells through addition for unique transcription factors or proteins that bind to DNA.

Project Proposal (cont.)

There is only a single treatment method using the OncoProbe. Each type of a cancer has a unique type of protein associated with it. Once the protein is identified using the OncoProbe, scientists use genetic engineering to make immune cells respond better to that specific protein. These ready-to-use plasmids are made for a library of cancer types are artificially introduced through the state-of-the-art recombinant DNA technology into the user-specific stem cell cultures.

These stem cells are then harvested under optimal conditions to make T-cells. Once there enough T-cells, a vaccine is made for the user and sent to the primary care physician. Furthermore, the vaccine is made with dosages efficacious to the health of the user. Users can monitor the levels of their cancer protein through the OncoProbe through the stages of vaccination.

Conclusion

For further scientific progress, the potential of stem cells for regenerative medicine needs to be realized by the general public. Scientists from different disciplines as well as artists must work together in this campaign of public awareness for stem cell research.

This portable diagnostic tool provides a novel mean for users to electronically be informed about their health status, including cancer diagnostic and treatment plans. Once the user realizes the therapeutic potentials that stem cell research harbour, the increase in public support will allow for more funding available to pursue areas of medical research that would not have been possible otherwise. Although this may be science fiction at the moment, smaller parts of the project can be developed into a reality. For example, the project can be done on a small scale to educate users about the therapeutic potentials of stem cell research. However, government support may be necessary to drive this project.

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