

Project Report in Experts in Teamwork

TBT4850 - Stem Cells Studies: Research and Ethical Aspects

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Abstract

This project report aims to describe how we made a PowerPoint animation, why we made the animation and how our product can be used to raise awareness concerning stem cells and their applications in diseases; more concrete leukemia, diabetes type two and alopecia (baldness). We address bigger ethical issues concerning these treatments to make the viewer aware of, and reflect on, the issues connected to stem cells. The molecular basis and applications are described in a way that it is suited to be distributed to an audience from the age of 16 and up. The product is distributed through our own webpage (<http://folk.ntnu.no/birgitmc/eit/>), Facebook, YouTube and hopefully through The Norwegian Biotechnology Advisory Board.

We feel this product give an alternative approach to explaining stem cell applications to the adult public. In the animation, we have included the essence of the science behind the different applications and simplified it in order to increase awareness and curiosity regarding this topic. We believe that our product is of important social relevance because it is based on scientific reports, has been simplified and distributed through popular media in order to reach a broad audience.

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1. Introduction

This report starts by describing our project questions and moves on to our motivation for making a movie. The report continues by explaining how we decided on which computer program to use and why we settled on using PowerPoint. The storyline is described and the different characters in the movie are introduced. We raise certain issues regarding each scene and discuss why they were made the way they are.

The report is summarized with a discussion of how to distribute our final product through our own website, YouTube, Facebook and The Norwegian Biotechnology Advisory Board.

1.1 Project questions

Our project aims to increase public awareness on stem cells; *what are they? How can we use stem cells to cure diseases like diabetes type 2, blood-cancer and improve treatments for hair loss? What is the molecular basis, the psychological and ethical issues connected to these diseases and situations? How can we distribute and explain it to the adult public?*

The group has a broad basis in medicinal, molecular and cell biology as well as biological psychology and process engineering. The challenge lies in distributing and including our disciplines in an actual product that will answer the questions above and help enlighten the public around 16 years of age and above about stem cells. The goal was to make a movie that:

- 1. Describes the basics of stem cells**
- 2. Explains how stem cells can be used to treat blood-cancer, diabetes type 2 and baldness**
- 3. Address ethical and psychological issues and most importantly**
- 4. Is aimed to increase knowledge on stem cell applications to the adult public**

1.2 Motivation

We had several sources of motivations for choosing an animation as the final product. First, a movie is easily distributed through the internet and it is easier to catch public's attention with a virtual product than for example a written text. Second, by animating we can simplify the explanations for the molecular basis of the different treatments. Third, by having the public watch a movie instead of reading a text they will hopefully remember the cases, and therefore also our message, longer.

Having one group member who is not very familiar and confident with the English language, making a movie helped us circumvent possible language problems. If we chose to write a report instead of animating, the contribution from that person might have been smaller compared to the other group members, and we wanted to avoid this possible problem. Making the animation was also a motivation in itself because it enables us as a group to be creative as well as scientific. The project was a valuable opportunity to use our imagination and to do something completely different than writing reports, which is the usual and scientific way of addressing topics within our disciplines.

2. Making the animation

When we decided to make an animation as our product, we were basically moving into an unknown territory concerning that none of the group members had made an animation before. In order to make the animation we needed a free and easy to use program installed on our computers. We also needed the program to have recording opportunities. We quickly discovered that PowerPoint filled all our criteria, and that all group members, except one, had the program already installed on their computer. When we started animating it was obvious that making an animation would be challenging and very time consuming. To meet the set deadline, it was decided that each group member had to work between each Wednesdays in addition to the village days. During this process we have had major computer problems; files crashing, recordings that had to be done twice and then redone and problems with putting all the files together. This made the process of making a movie a lot more challenging than anybody could have expected. We spent late hours at school and countless hours of our spare time to make the final product which we are proud of.

2.1 Making the animation in PowerPoint

We wanted to include several characters and longer dialogues in our animation. This had the consequence that we had to make the characters simple and easy to manipulate. When making the movie we have only used drawing and animation functions in PowerPoint. The voices and sound has been added with PowerPoint's own recording and sound options using a web camera microphone as voice recording device. In order to record the voices we choose "Slide Show" in the PowerPoint menu line. The slide that is to be recorded is marked and we press "Record Slide Show" and choose "Start Recording from current slide". Then, a pop-up box occurs and both boxes should be ticked before pressing "Enter". Then the recording starts. When we did the recordings each dialogue was printed out and marked. The marks indicated when to press "Space" when recording. A star indicated that the slide had animations, while a line indicated the end of the slide. It was important to indicate because we then knew if two people were talking on the same slide, which required more practice and practical issues when recording. This part of the project was challenging to overcome because we needed a quiet room to avoid background noise. It was also challenging to read the different voices because a lot our characters are males and we have only one male in the group. The female group members had to modify their voices in order to make them sound masculine.

Figure 2-1 shows the main character the doctor and his dog. As can be seen in the figure, the characters have freely moving hands in order to make the movement clear for the viewers and easy for us as animators. The facial expressions are also easily manipulated. The characters are made with figures and drawing functions in PowerPoint. The figures in themselves are somewhat simple, but it still took a while to finish them and give them a personality.

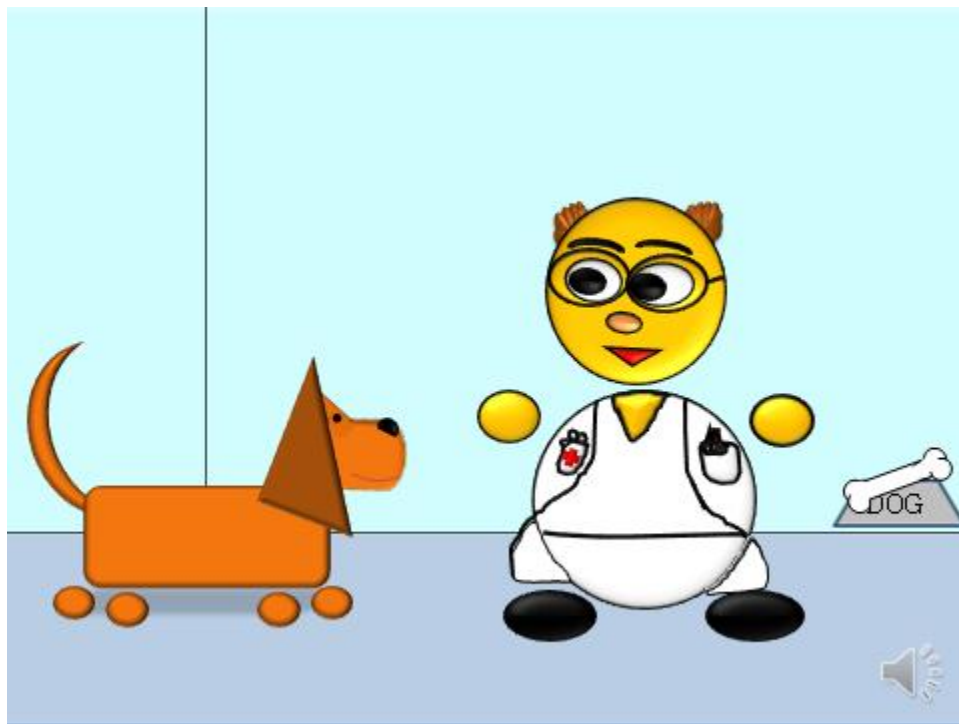


Figure 2-1: The doctor and his dog.

PowerPoint was good tool for this kind of animation because we could have movement on each slide and did not have to make several slides in order to make the characters move, like in old fashioned cartoons. It makes the movie resemble an actual animation as the slides actually are animated. Figure 2-2 a) and b) shows an example of the beginning and end of one single slide.

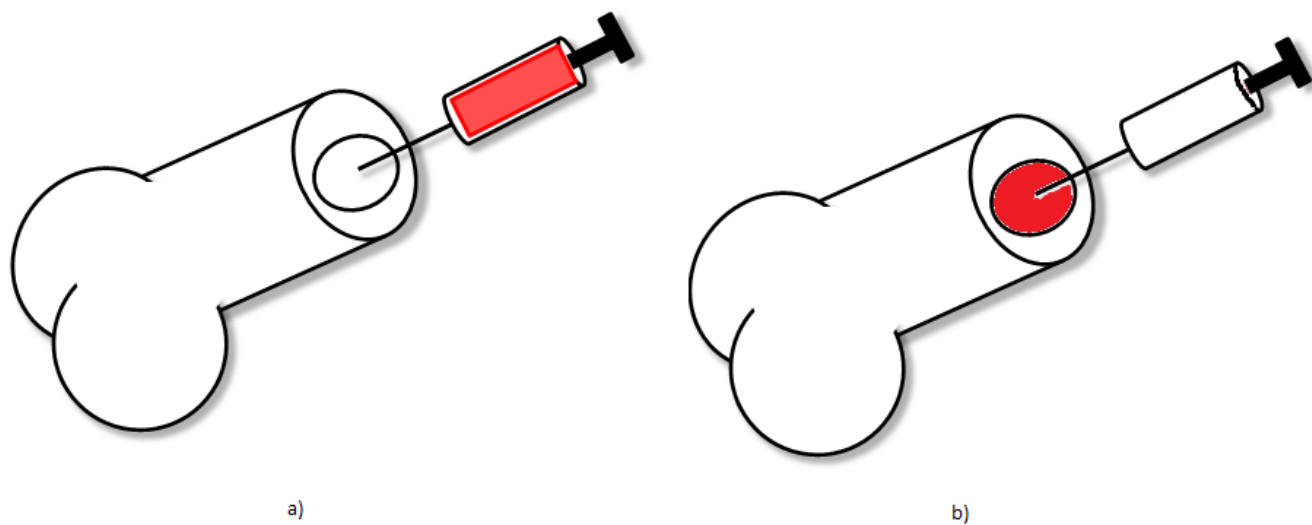


Figure 2-2: Animations done on the same slide in PowerPoint.

Part a) shows and empty bone and needle with bone marrow stem cells, and part b) shows the injection of stem cells.

Figure 2-2 does not show the actual animation for obvious reasons. This slide in the actual movie shows stem cells (red colour) being injected from the syringe and into the bone. Throughout the animation we switch between scenes where the characters are talking face to face and scenes where the entire screen shows the treatment or molecular basis of the diseases (illustrated in figure 2-3).

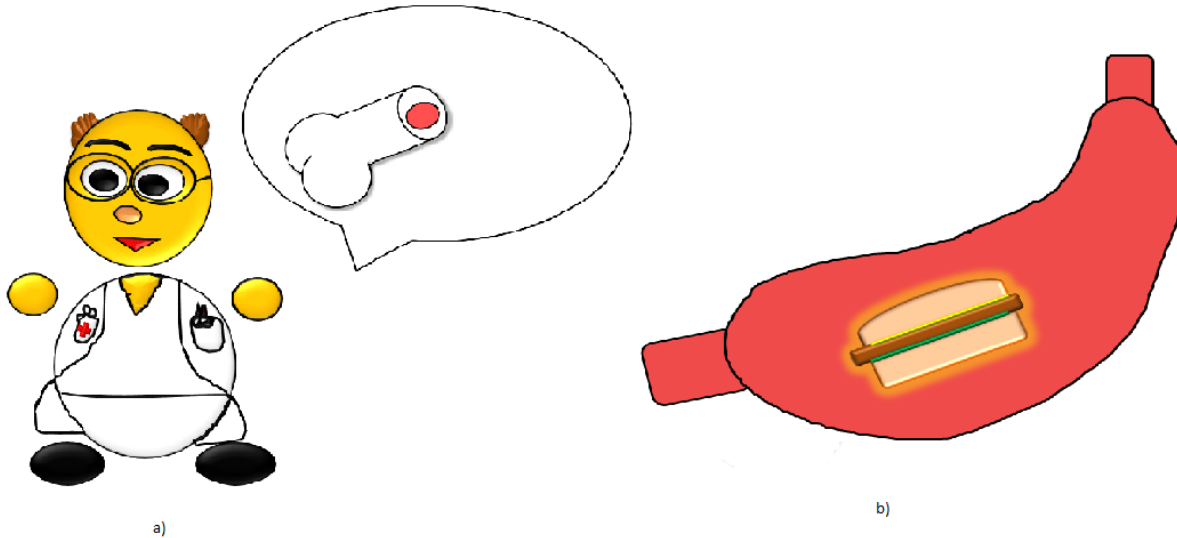


Figure 2-3: Illustration of different scenes in the animation. a) Shows the doctor talking and b) shows the stomach digesting a hamburger in order to explain how insulin helps the intestines to absorb nutrients.

2.3 The storyline

Our story happens sometime in the future and is seen from the viewpoint of a doctor who uses stem cells to cure his patients. The main character, Doctor Peters, has a dog the viewers meet in the beginning and in the end of the movie. We chose the dog to be the character that should ask simple questions about stem cells like; *what is a stem cell? How can it be used in disease treatments?* The reason for this was partially humorous and partially because it was one of our initial ideas. We also use the dog in the final discussion on ethical issues asking critical questions.

Sadly, we had to exclude a scene from the movie. This scene described how skin renewal could be possible by using a stem cell cream with dermal growth factors. We had to skip this scene because we did not have time to do the voice recordings for it. The initial plan was to have the scene between the baldness scene and the scene addressing ethical issues. The scenes dialogue is included in Appendix A together with all the other dialogues, and the deleted scenes storyline is included in Appendix B.

2.3.1 Introduction

The aim of the introducing scene is to give some basic knowledge concerning stem cells in order to give the viewer some knowledge in stem cell biology and thus make it easier to follow the animation.

The movie starts with the doctor leaving home to go to work. Based on the short conversation before he leaves the dog decides to do some research on stem cells because he is curious about his owner's job. During this scene the basics of cells is described and the animation shows how an egg cell is fertilized to give a zygote. Then the different types of stem cells; the mono-, multi- and pluripotent stem cells are introduced and described.

2.3.2 Leukemia

In this scene we describe how a cancerous pluripotent stem cell can cause leukemia and how it can be treated with stem cell therapy.

In the next scene we meet the doctor at his office with the first patient of the day. The first patient is a woman with leukemia; more specified Acute Myelogenous Leukemia (AML). Figure 2-4 shows Mrs. Jones, the patient.

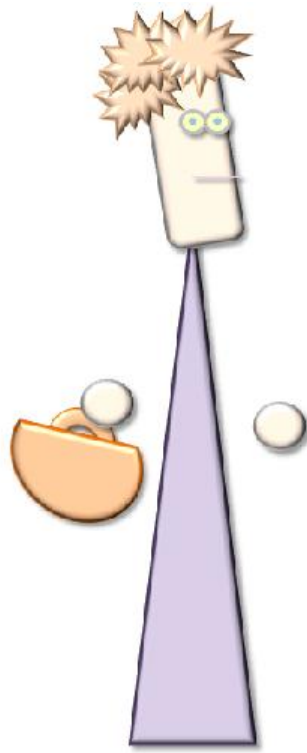


Figure 2-4: Leukaemia patient, Mrs. Jones

The dialogue starts with the doctor explaining the three main components in the blood, the white and the red blood cells and blood platelets. He continues with describing how these cells are made in the bone marrow from pluripotent stem cells called hematopoietic stem cells. Figure 2-5 shows how this is presented in the animation.

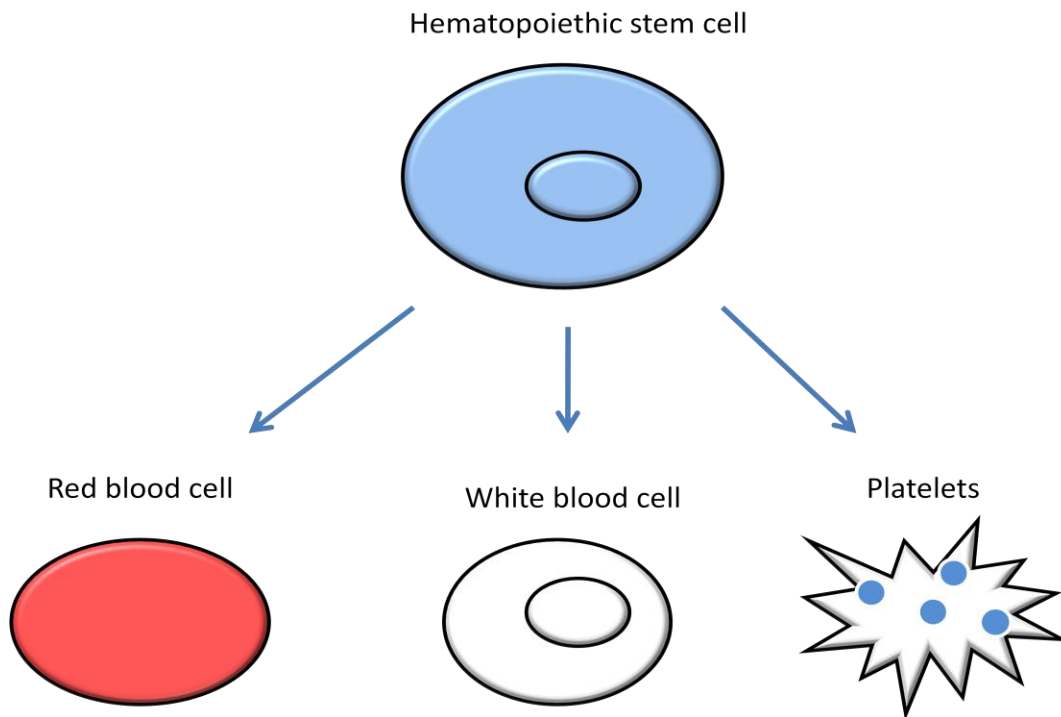


Figure 2-5: Hematopoietic stem cell. The figure shows how a pluripotent stem cell, the hematopoietic stem cell, can give rise to red blood cells, white blood cells and blood platelets.

The doctor explains how a cancerous hematopoietic stem cell gives rise to leukemia. He continues by explaining how it used to be treated in the “old days”, and how the stem cells from a stem cell bank can be used in order to treat AML. The treatment being described is actually being used to cure people with AML today.

In this first patient scene we also included some psychological issues by mentioning depression as a possible side effect resulting from the treatment.

The reason why we chose leukemia as one of the diseases was because the treatment described actually is being performed in some countries like USA today. It was important to us that the movie did not end up being a too futuristic, and thus unrealistic, movie about stem cell treatment.

2.3.3 Diabetes type 2

This scene aims to describe what diabetes type 2 is, how it effects affected individual and how injecting stem cells into the pancreas can treat diabetes type 2.

The next patient is a girl who is diagnosed with type 2 diabetes. She is a young adult named Susan (See figure 2-6).

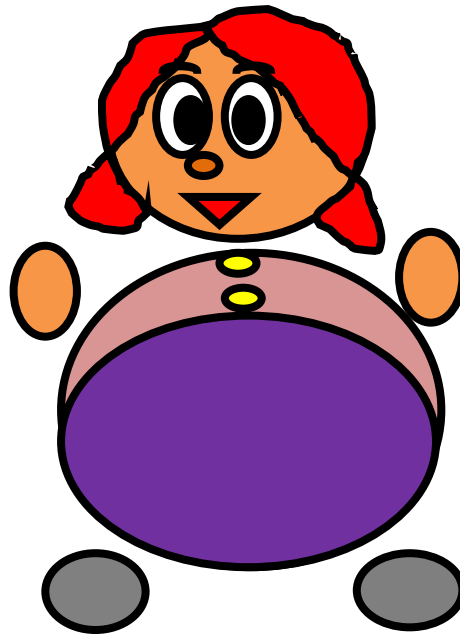


Figure 2-6: Diabetes type 2 patient, Susan

During the scene, Doctor Peters explains how food is broken down in the stomach and how glucose is taken up in the blood in a healthy individual. He continues by explaining how β -cells in the pancreas make insulin and that these cells are damaged in patients with type 2 diabetes. These cells are also the basis for the stem cell treatment. Purified bone marrow stem cells are injected into an artery near the pancreas and Susan is placed under pressure in an oxygen chamber. This induces the growth of β -cells and normalizes the insulin production. A person going through with this treatment does not have to monitor the blood glucose levels anymore and therefore does not have which requires carrying around a blood glucose monitor and insulin. The treatment that is described is being tested on humans and is, based on the references, promising. As already mentioned in the leukemia scene, it was important to give examples treatment that is being executed or tested on humans in order to make the movie more realistic.

2.3.4 Alopecia (Baldness)

In this scene we aim to describe different types of baldness, the psychological issues connected to baldness and how being bald can be treated by using stem cell therapy.

The scene starts with a phone call from psychologist Stevens to Doctor Peters. The psychologist wants to transfer one of his patients to Doctor Peters. Psychologist Stevens is concerned about his patient, Tom Baldwin, because he used to be outgoing and successful, but after his hair loss his self-esteem has decreased dramatically. Next, Tom Baldwin shows up at the doctor's office and Dr. Peters gives him a thorough examination explaining the different types of hair loss and how hair loss can be. The treatment then carried out by taking a scalp sample, extract stem cells in the hair follicles and cultivating them in the lab. Figure 2-7 shows Tom Baldwin before and after the treatment.

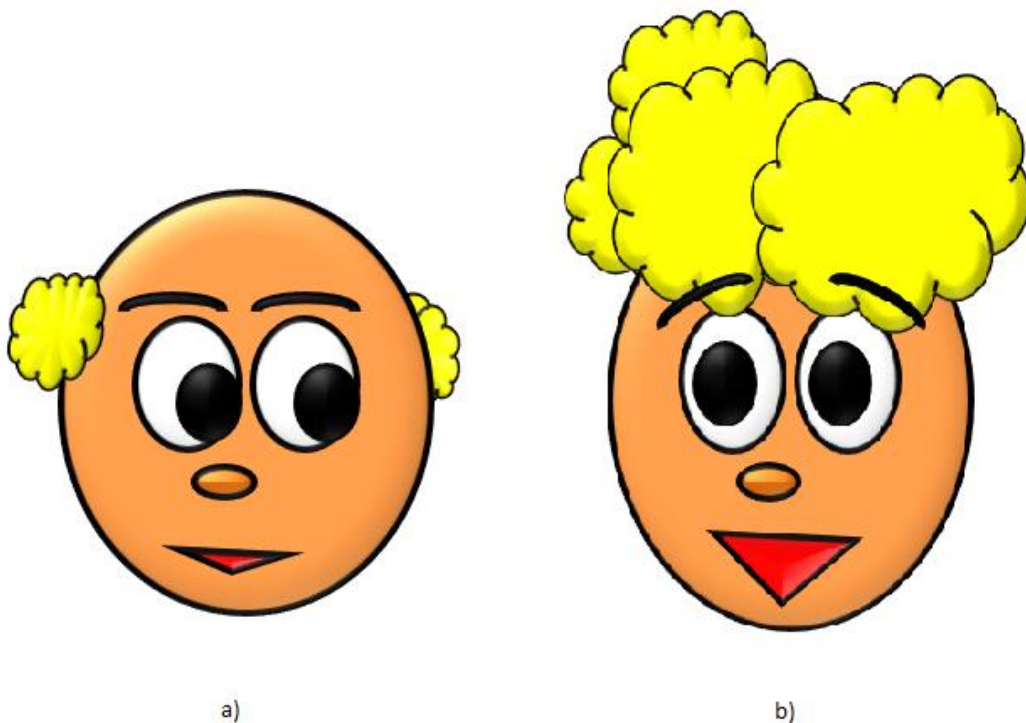


Figure 2-7: Tom Baldwin a) before and b) after hair treatment with stem cells.

Also in this scene we have included some psychological aspects as well as chemical engineering aspects when describing stem cell therapy.

2.3.5 Ethical issues regarding the different treatments

The next scene takes place in Dr. Peters home. The scene is once again a dialogue between him and the dog. They discuss ethical issues concerning Dr. Peters' use of stem cells. In this part of the movie we had to shorten the discussion to shorten the movie. Some of the main ethical issues as we see it are the use of embryonic stem cells; the difficult discussion on when a human mind develops and is to be recognized as a human being. But in order to stay in touch with the storyline we decided not to include these topics in the dialogue. One argument is that in the treatments described, Dr. Peters use stem cells from the umbilical cord collected in the stem cell bank, and not embryonic stem cells from discarded embryos. Including that in the scene might have confused the viewer, and did not really have any relevance for the movie. Instead we decided to raise some of the big questions to invite the viewers to reflect and think on their own on the use of stem cells and how it can change society in a good or a bad way.

2.3.6 Last scene: Phone call from Tom Baldwin

The final scene in our animation is a phone call from the former bald guy, Tom Baldwin. He calls Doctor Peters from a party and to tell him that his hair has grown back and that he is very happy. One of the slides is shown in figure 2-8.



Figure 2-8: The finale scene. Tom Baldwin calls Doctor Peters to tell him that his hair has grown back.

We wanted to have a happy and funny ending to our movie. Placing the funny scene after the ethics scene seemed like a good idea. By making this our final scene we have closure to our final patient and we hopefully leave the viewers with a positive impression of stem cell treatment. Since hair loss is not as severe as the other diseases we have described, it is easier for us to joke about this topic and make conclusions on how it will work in the future. Despite this, we want to underline that alopecia also can have serious consequences and is not just a joke.

3. Distributing the animation to increase public awareness

By making this movie we aimed to explain the science and rationale behind stem cell application to a non-scientific audience in order to increase their knowledge on this topic. Since stem cells is a highly controversial issue on the political level, increasing the overall knowledge of stem cells and their applications can increase the voters knowledge and helping them form their own opinions. This can again help them in the future debate concerning stem cell banks and applications. If the voters do not have any knowledge about the issue at hand, how are they and the society going to cope with the ongoing research on stem cells, and how is society going to react when it is confronted with stem cell therapy in the future?

Increasing knowledge and curiosity concerning stem cell studies and important applications is indeed of democratic and ethical importance. If a person with diabetes type 2 is against stem cell research for no certain reason, but is not aware of the benefits for treating his/her own disease, the person will probably vote against stem cell research if given the chance. If a patient is faced with a treatment that includes stem cell therapy, an educated patient will be more qualified in deciding for or against the treatment. On the other hand, increasing the knowledge on stem cell therapy can make patients demand stem cell therapy. In our opinion increasing stem cell awareness needs to address a larger audience, as we have demonstrated with this animation, to be successful.

Using a common disease as an example for stem cell treatment is, in our minds, a better option than bombarding the public with difficult scientific terms. By illustrating the treatment with some simplified animations, we make it easier and thus more interesting for a younger audience. That is one of the main

reasons why we decided to make a movie instead of writing a scientific report. Also, by applying stem cell therapy on humanlike characters, like in our project, can open the eyes of non-scientist and scientists of other disciplines on therapeutic benefits of stem cells.

Biotechnology research in Norway is restricted by the laws implemented and recommended by amongst others The Norwegian Biotechnology Advisory Board (in Norwegian: Bioteknologinemda). We sent them an e-mail briefly describing our project. We also asked if they were interested in distributing the movie on their website or if they would like to link it in some way or another. They replied that they will consider it when the finished product is published on YouTube. Getting help to distribute our product through The Norwegian Biotechnology Advisory Board would be beneficial, but in the meantime the movie is being distributed on our website:

- <http://folk.ntnu.no/birgitmc/eit>

Our movie has also been distributed in three parts on YouTube:

- Part 1: <http://www.youtube.com/watch?v=z3KHwUyVgiQ>
- Part 2: http://www.youtube.com/watch?v=7re_HSKs7Wc
- Part 3: <http://www.youtube.com/watch?v=8zvM89fJOjQ>

In addition to this, we have created a group on Facebook called “*Ethical Issues on Stem Cell Research*”.

We want to emphasize that knowledge of the ethical issues are just as important as being aware of the therapeutic possibilities and complications of stem cells. As we argued in chapter 2.3.6 it was important to us to make the viewer more aware of these issues and hopefully make the viewers come up with their own opinion.

We are aware that the product is somewhat biased since none of the individuals in the group are against stem cell therapy. Since this product is only a prototype, an improvement of the product would include feedback from an audience and further debates on the ethical issues amongst other scenes. If this product is to be improved in some way the group thinks that it would be a better product if the deleted scene on skin treatment was included. Improving the animations, voices and adding music would also capture a broader audience. In a later stage of this project, the psychological aspects concerning the therapies could also be included *e.g* the uncertain future, pain caused by the therapy and concerned family member.

4. Summary

In this project we have raised and answered the question of how having a stem cell bank can lower the risks of stem cell therapy and how stem cells can be used to treat leukemia, diabetes type 2, baldness and skin aging problems. We have explained the molecular basis of leukemia, diabetes type 2, skin impairment as well as the cellular basis for baldness. The descriptions are of such a character that the movie is suited for distribution to an audience aged 16 and above. We are distributing our product, minus the skin treatment scene, through our own webpage (<http://folk.ntnu.no/birgitmc/eit/>), Facebook, YouTube and hopefully through The Norwegian Biotechnology Advisory Board.

We believe that our product is of important social relevance because we have used our expertise within science and technology to extract the essences of stem cell applications from scientific reports and explained it in a way that makes it easy to comprehend. We believe that the majority of the population does not read scientific reports on this topic for several reasons; it is relatively new and difficult, it requires previous knowledge of the topic and higher education to understand the main points in the reports. We think it is important to increase the knowledge on this topic, but it needs to be done in a “non-scientific” way and thinking outside the box in order to capture the audience.