How I Prepare Myself to Be Cloned

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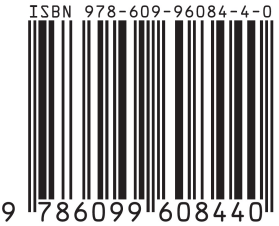

Introduction

This paper introduces my research on humans at a molecular level, including cloning and manipulations in a genome. Although cloning animals in scientific research has been explored for decades,[1] it is still considered by many as unethical, especially when it comes to cloning humans.[2] Nevertheless, the possibility exists, and it is only a matter of time until the first human will be cloned. The paper entitled "How I Prepare Myself to Be Cloned" is a provocative reference to the possibility of cloning my own body, but is not necessarily the goal of the paper. This paper, however, looks into scientific and artistic projects that have used the cloning of animals or the modification of their genetic code, and invites one to experience the manipulation of the human genome at practical and aesthetic levels. The toolkit associated with this paper (Fig. No. 7.) enables the analysis of a genome at home.

In nature, identical plants, for example, grow from a single cell or from a number of seeds matured in the plant. Unicellular organisms or cells of multicellular organisms start their division by splitting their genetic code and making out of it two identical copies, which, in turn, would trigger the division of the cell into two identical copies.

Historically, humanity has noticed similarities in a variety of organisms that triggers its fantasy. On one hand, organisms have been depicted in repetition in historical imagery, as in slaves in Egyptian murals or animals in Mesopotamian reliefs. On the other hand, organisms have also been presented as hybrids. In ancient spoken and written stories or depicted scenes, we meet a number of

*1. See "Cloning" at https://en.wikipedia.org/wiki/Cloning (Accessed: 27 October 2017).
*2. See "Human cloning" at https://en.wikipedia.org/wiki/Human_cloning (Accessed: 27 October 2017).

mythological hybrids carrying parts of different organisms: Pegasus was imagined as a horse with wings, centaurs appeared as half-human and half-horse, mermaids were composed of fish and women. Although practically these hybrids didn't exist and were achieved through an inherent faculty of divine intervention, during the course of evolution hybrids of a certain level were also bred in the real world: Mules came into being while breeding a female horse with a male donkey, and shoats came about while breeding a sheep with a goat.

Donna Haraway's question of "who 'we' will become when species meet" (Haraway, 2008) is rather philosophical, projected into the future and further evolution. On the other hand, if I think of contemporary biotechnologies and CRISPR/Cas9 as methods for modifying organisms, the metaphor proposed by Haraway becomes very important within the discourse of cloning and transgenic species, especially those within the animal kingdom. What will happen over the course of future evolution if organisms are programmed and reprogrammed? After this intentioned human (re)programming, how far will the newly shaped organisms continue to mutate over new generations in order to adapt to changing environmental conditions?

While cloning is a natural process of reproduction in an organism, advances in molecular biology at the end of the 20th and at the beginning of the 21st century have completely changed the understanding of cloning, including mastered modifications of a cloned organism. The year 1996 is marked by the cloning of a sheep from an adult somatic cell,[3] and 2015 became a breakthrough year in genome-editing, allowing one to "cut" and "paste" specified DNA targets into the genome of an organism.[4] Since the end of the 20th century, genetically modified organisms, or GMOs, have become a standard in the food industry.

In artistic practice, the manipulation of a genome is rather an exception. At the same time, working with a genome and questioning its manipulation at an aesthetic level is a challenge because of limits in its (re)presentation.

The first part of the paper introduces artistic and scientific projects related to cloning and genetic manipulation. The second part of the paper lays out three experiments, guiding the reader and the toolkit user to practical work with molecular biology. Able to experience the basic idea of life while using the tools provided, the user should be able to participate in discussions around issues of cloning and the genetic modification of animals.

*3. https://en.wikipedia.org/wiki/Dolly_(sheep) (Accessed 29 October 2017).
*4. http://www.sciencemag.org/news/2015/12/and-science-s-2015-breakthrough-year (Accessed 29 October 2017).

Related Scientific and Artistic Projects

Dolly

Dolly is a sheep that was cloned at the Roslin Institute in Scotland in 1996 (Fig. No. 1). A cell taken from a mammary gland in a six-year-old sheep was altered and implanted into an egg from a surrogate Scottish Blackface sheep, which, through a normal pregnancy, gave birth to a healthy offspring.[5,6] Interestingly, Dolly was born from a somatic and not a reproductive cell, meaning that, at any time, any cell taken from an adult could be reprogrammed into a reproductive stem cell.

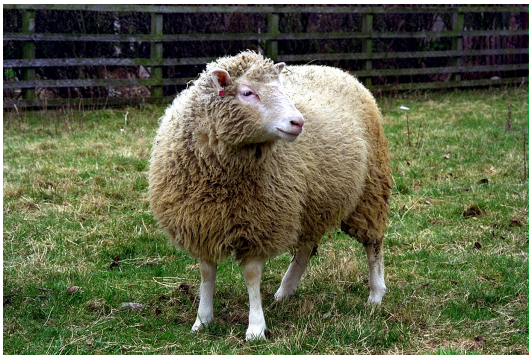

Fig. No. 1. Dolly. Photo courtesy by the Roslin Institute, University of Edinburgh. Source: http://dolly.roslin.ed.ac.uk/

*5. http://www.nature.com/articles/ncomms12359 (Accessed 29 October 2017).
*6. http://dolly.roslin.ed.ac.uk/facts/the-life-of-dolly/index.html (Accessed 29 October 2017).

The idea of being able to clone a mammal from an adult cell gives way to the idea of cloning a human, which, by now, is banned by civil law all over the world. Nevertheless, the research is still being done at the embryo level to gain further scientific knowledge. The technique used – somatic-cell nuclear-transfer – combined with the CRISPR/Cas9 gene-editing technique might change expectations for cloning mammals, including humans.

GloFish

At least 74 attempts at animal modification where counted in 2015 by A. Lievens and colleagues (2015). While genetically modified animals are not yet produced for human consumption on a large scale, news associated with them still comes up. In 2015, genetically modified salmon was approved for consumption in the US by the Food and Drug Administration and showed up on the market in 2017.[7] GloFish (Fig. No. 2), the first genetically modified pet, have been around in pet shops in the US since 2004 (Nash, 2004).

Fig. No. 2 GloFish, orange and green tetra. Source: http://glofish.com

The GloFish is interesting because of its aesthetic value. Being a pet, its function is to entertain its host. Secondly, the GloFish includes the green fluorescent protein (GFP), which is widely used in scientific research. GFP modification is also used for educational purposes in high schools and colleges to teach students about recombinant DNA and protein purification techniques. Finally, even if genetic modification is restricted for domestic experiments, GFP modification was legalized by Berlin authorities in 2016 for educational purposes for use in home environments.[8]

*7. https://www.cnbc.com/2017/08/09/salmon-becomes-worlds-first-genetically-modified-animal-to-enter-food-supply.html (Accessed 29 October 2017).

Originally isolated from the jellyfish *Aequorea victoria*, scientists use the protein as a marker within a DNA sequence or as a concept of proof for genetic modification. Although GFP modification is considered harmless in organisms, some studies suggest its influence on animal aging, locomotive ability, and eye morphology. Therefore, it is suggested that GFP be used cautiously for genetic modifications (Mawhinney & Staveley 2011).

Eduardo Kac, *GFP Bunny*[9]

The transgenic artwork *GFP Bunny* was completed in February 2000 with the birth of a rabbit named "Alba" (Fig. No. 3). The project was an outcome of Kac's collaboration with zoosystemician Louis Bec and scientists Louis-Marie Houdebine and Patrick Prunet. The rabbit had altered genomics, carrying a fluorescent GFP, the same protein that was used to modify the GloFish. Genetically modified Alba was an albino rabbit with no skin pigment and with pink eyes. Under the daylight, it would look white, and, under blue light with a maximum excitation of 488 nm, the rabbit would glow with a bright green light (Kac 2000).

Fig. No. 3. *GFP Bunny*. Source: http://oslolux.wordpress.com/eduardo-kac

*8. In 2016 Rüdiger Trojok was using GFP for modifying E. Coli bacteria in his home laboratory. For more info see https://www.meetup.com/Biotinkering-Berlin/events/235107360/?_cookie-check=zc-l_hyy9qe64U94 (Accessed 29 October 2017).

*9. http://www.ekac.org/gfpbunny.html#gfpbunnyanchor (Accessed 29 October 2017).

In the description of the project, Kac wrote:
My transgenic artwork GFP Bunny comprises the creation of a green fluorescent rabbit, the public dialogue generated by the project, and the social integration of the rabbit.[10]

While the project generated huge attention in the media and was followed by a number of interpretations,[11] the social integration of the rabbit has failed, as it was never released from the laboratory.[12] This is despite the fact that Alba, like any other rabbit, sought interaction and, for example, sat comfortably in Kac's hands (Kac 2000).

For the genetic modification of Alba, scientists integrated GFP into the genome through zygote microinjection, the method most extensively used in the production of transgenic animals, including rabbits. The method suggests *in vitro* fertilization, which is done outside of the organism and therefore could be easily combined with the somatic-cell nuclear-transfer method used to clone Dolly.

There are a number of controversial discussions around the *GFP Bunny* project. Firstly, the photo of the fluorescent rabbit has been digitally manipulated. Secondly, there are different versions of the story of how long the rabbit was alive. Finally, according to Wired magazine, it is not clear if the rabbit was genetically modified as an artistic project from the beginning.[13] Nevertheless, the project gained enough attention from the media to be considered one of the most influential in Bioart.

Revital Cohen and Tuur Van Balen, *Sterile*[14]

Sterile is a project by Revital Cohen and Tuur Van Balen that is a genetically modified Albino goldfish (Fig. No. 4). At the Schering Foundation exhibition space in Berlin, it was shown alongside other works, including the video *Kingyo Kingdom*, which follows fish breeders in Japan while, at the same time, contextualizing the genetically modified fish and *Sensei Ichi-gō*, a machine capable of reproducing sterile goldfish. Within the project description, *Sterile* is described as follows:

*10. Ibid.
*11. See http://www.ekac.org/gfpbunny.html (Accessed 29 October 2017).
*12. https://today.duke.edu/2000/11/bunnyn03.html (Accessed 29 October 2017).
*13. https://www.wired.com/2002/08/rip-alba-the-glowing-bunny/ (Accessed 29 October 2017).
*14. http://www.cohenvanbalen.com/work/sterile (Accessed 29 October 2017).

Albino goldfish engineered to hatch without reproductive organs. They were not conceived as animals but made as objects, unable to partake in the biological cycle. An edition of 45 goldfish was produced for the artists by Professor Yamaha Etsuro in his laboratory in Hokkaido, Japan, following an intricate collaboration process which began in 2011.[15]

Fig. No. 4. *Sterile*. Source: http://containerartistresidency01.org

The important part of the project is that the fishes were not sterilized after they were born, but were genetically modified in order to not have reproductive organs. In such a way, the artists showed their responsibility in front of the whole ecosphere, because the genetically modified animals will not continue breeding later. Having the fish born sterile, the project questions genetic modification done by humans in relation to a naturally evolving environment.

Moreover, an important message in *Sterile* is the blurring of the borderline between object and subject: whether a fish being technically engineered to become an object or a machine programmed to become similar to a living organism. The idea of an object becoming a subject and vice versa has been conceptualized around the machine-human rhizome within the context of the umbrella project of this paper, *Introduction to Posthuman Aesthetics*, which proposes a subjective perspective on discourses in contemporary aesthetics.

Joe Davis, *Microvenus*

Microvenus is a genetically modified *Escherichia coli* bacteria strain carrying a piece of a synthetically composed sequence of amino-acid molecu-

*15. Fig. 5. Sterile. Source: http://containerartistresidency01.org

les. It was first cloned into several laboratory strains of *E. coli* in collaboration with molecular geneticist Dana Boyd at Jon Beckwith's laboratory at Harvard Medical School in 1988. As bacteria are small and invisible to the human eye, the artwork, instead of being visually "aesthetic," is instead left to the imagination. Davis introduces the *Microvenus* as follows:

> *Each Microvenus organism contains many copies of a special molecule designed by the artist and his colleagues. The artistic molecule is a short piece of synthetic DNA containing a coded visual icon that has been incorporated into a living strain of bacteria (E. Coli). (Davis 1996)*

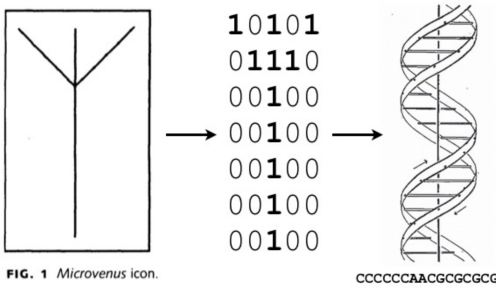

FIG. 1 *Microvenus* icon.

Fig. No. 5. *Microvenus*. Source: http://unmondemoderne.wordpress.com

The coded icon is the symbol for "life" from a Germanic rune. Resembling letter Y, it also represents a female Earth in different mythologies. The graphical image was converted into the bit-map image and further into DNA base pairs in order to synthetically program and be attached to the original DNA code of the plasmids carried by bacteria (Fig. No. 5). Davis has imagined that the code could be interpreted by extraterrestrials, as the final stage of the project was supposed to include shipping of the modified bacteria into the universe.

Microvenus is compelling from different perspectives. First of all, it is the first genetically modified art work. Secondly, Davis' idea to encode and store data in DNA in the late 80s was a couple of decades ahead of a scientific project presented by the CUHK team at the iGEM competition in 2010.[16] Finally, thinking of extraterrestrial intelligence, it probably makes sense to consider communication happening at the very basis of life, within the chemical interactions between different molecules. So, encoding and reading genetic information could potentially provide many answers about different life forms.

*16. http://2010.igem.org/Team:Hong_Kong-CUHK (Accessed 29 October 2017).

Concept

Cloning is a complex issue involving scientific knowledge, civil law, and ethical questions yet to be solved by humanity. On the other hand, the methodology used for cloning animals is not that complex and could be easily imagined with the use of simple tools.

Referring to mythological hybrids like centaurs, mermaids, and minotaurs, the toolkit, the tutorial, the paper, and a number of experiments associated with the manipulation of a genome, the project aims at envisioning possible shapes, functions, and needs of non-human humans. While practically “disassembling” the cells, amplifying the genetic code of cells’ DNA, and analyzing DNA, the user of the kit is invited to experience life at a molecular level.

Along with a manipulated genome, the question raised in this project is of the engineered self. To what extent could it be possible to modify one’s own DNA, or, even, to give birth to a modified self? How much self will remain?

Cloning Mechanism of Animals and Modifications of Genome

In the paper “My Collaboration with Bacteria for Paper Production,” which is devoted to symbiosis, I have briefly introduced interactions between chemical and organic elements, which, while interacting, trigger evolutionary processes. These processes wouldn’t have been possible without the organism’s ability to self-replicate and mutate while adapting to changing environmental conditions. While self-replication is just another term to define cloning processes, the mutation of the organism in the natural environment could be compared to natural breeding or to engineered genetic code.

Somatic-Cell Nuclear-Transfer Mechanism

While self-replication is a natural process in unicellular organisms, cell division, and spore formation, within this research importance is laid on cloning animals that sexually reproduce or, to be more precise, the method for mammal cloning that was used to clone the sheep Dolly.

Dolly was cloned using the somatic-cell nuclear-transfer (SCNT) mechanism, a technique for creating an ovum with a donor nucleus. The mechanism was rather simple: A cell from one sheep was used for the extraction of the nucleus, and an egg cell without a nucleus from another organism was used for the implantation of the extracted nucleus. In vitro fertilization and a microinjection technique were used to insert the nucleus into the donor sheep, causing the further development of the embryo and, finally, the birth of Dolly (Fig. No. 6).

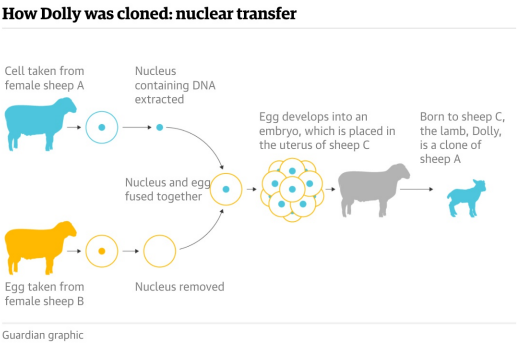

Fig. No. 6. Somatic-cell nuclear-transfer to clone Dolly. Source: The Guardian

The SCNT mechanism for cloning Dolly was also used to clone other mammals, including dogs and cats. The owner of the patent, the Korean company BioArts International, stopped providing its commercial service in 2008 because of lack of interest and competition in the black market.[17] The company's cloning vendor, the Sooam Biotech Research Foundation of Seoul, still offers the service. On the other hand, their last competition, to clone a beloved dog, was announced on the 25 November 2013. According to the foundation, the biggest hurdle to cloning mammals from an adult cell is still the low rate of pregnancy, reaching as low as 2%,[18] and the price, reaching 100,000 US dollars per clone.[19] Other sources also report a high number of abnormal fetal developments. [20]

*17. https://www.petwellbeing.com/blog/news/worlds-first-pet-cloning-company-discontinues-service (Accessed 19 April 2019).
*18. http://en.sooam.com/dogcn/sub03.html (Accessed 29 October 2017).
http://dolly.roslin.ed.ac.uk/facts/cloning-faqs/index.html (Accessed 29 October 2017).
*19. http://en.sooam.com/dogcn/sub06.html (Accessed 29 October 2017).
*20. https://www.ncbi.nlm.nih.gov/books/NBK215769/#!po=26.9912 (Accessed 29 October 2017).

Genetic Engineering

Genetically modified organisms, or transgenic organisms, are able to express foreign genes. This means that the genetic code is similar for all organisms, and a specific DNA sequence will code for the same protein in all organisms. Cutting out a gene responsible for reproduction, as was done in Revital Cohen and Tuur Van Balen's *Sterile*, will not code related protein and thus will disable a function that the DNA sequence was supposed to code. While adding a GFP gene, as was done in Eduardo Kac's *GFP Bunny*, would add the ability of the organism to glow under a UV light.

Although the genetic code in different organisms is similar, different organisms carry different cellular structures and can be genetically engineered differently. For example, unicellular prokaryotes like *E. coli* bacteria are engineered under electric or heat shock, while multicellular eukaryotes like plants might be engineered naturally using Agrobacterium tumefaciens or in the lab using the same microinjection as was used to clone Dolly, or other mechanisms, including a gene gun, electroporation, and CRISPR/Cas9. Multicellular eukaryotes (such as animals) have an even more complex system for engineering, though, as in plants, they could be engineered using both lab and natural methods. On one hand, engineering could be done with the help of viruses that are able to carry the genetic code attached to them. On the other hand, animals could be engineered using lab methods, likewise including microinjection, a gene gun, and CRISPR/Cas9. Depending on a specific DNA sequence, the methods could be combined. For example, the GFP gene could be amplified in the plasmids of *E. coli* bacteria and then, while using microinjection, attached to the chromosome of a multicellular organism. The GFP gene could also be amplified using the polymerase chain reaction (PCR) technique and inserted into a cell using the gene gun technique.

Although the methods introduced are used for cloning and genetic modification, this paper will not introduce how to clone oneself. Instead, the experiments introduced below will give an idea of the DIY methods for genetic analysis and manipulation. Altogether the project remains an artistic framework for experiencing life at a molecular level and raises a number of questions related to molecular biology.

Fig. No. 7. Kit for preparation to be cloned.

Toolkit

The DIY tools provided (Fig. No. 7) help to look at genetic code and to diagnose mutations in a genome, if any. While mutations could vary and result in different diseases, I suggest focusing on a gene sequence that is responsible for breaking down lactose. The experiments introduced will give us an answer if the inspected person tolerates lactose, found in milk and other dairy products.

We will do three experiments:
- A polymerase chain reaction;
- A gel electrophoresis;
- DNA fingerprinting (Gapševičius, 2019).

Experiment 1: Polymerase chain reaction

In this experiment we will amplify the LCT gene's regulator. For the amplification we will use a polymerase chain reaction technique. In order to amplify 50 µl of the sample, we will need:

Samples and chemicals:
- A sample of saliva – 1,25 µl;
- Phusion DNA polymerase from Thermofisher1 – 1 µl;
- 2x of Phusion buffer from the Specimen Direct PCR Kit – 25 µl;
- Forward and reverse primers[22] – each 2,5 µl of 10 µmol working solution;
- Distilled water – 17,75 µl;
- Paraffin or other mineral oil – 10 µl.

Equipment:
- A thermocycler with a power supply and an Arduino microcontroller;
- Eppendorf 1,5 ml tubes – 3 units;
- Eppendorf 0,5 ml tube;
- A DremelFuge;
- A 1 to 10 µl pipette;
- Pipette tips – 8 units;
- A computer with the Arduino and Python 3 software preinstalled;
- A Python script to control a thermocycler.

- To begin with the experiment, connect the thermocycler with the Arduino in order to control it. Also connect the power supply to provide voltage to it (Fig. No. 8).

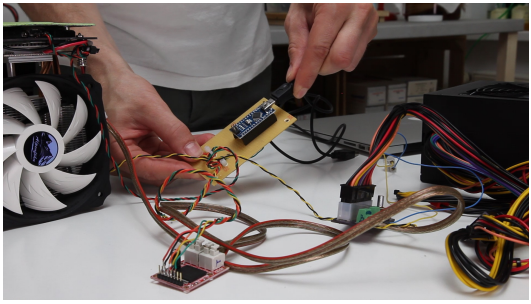

Fig. No. 8. Thermocycler connected with the Arduino and computer. Photo: Brigita Kasperaitė.

*22. Forward (5'-GTTGAATGCTCATACGACCATG-3') and reverse (5'-TGCTTTGGTTGAAGCGAAGATG-3') primers. Order the primers for example at https://webstore.biomers.net/OligoOrder/OligoOrder.aspx (Accessed 2 September 2018). The XS amount including will be sufficient.

- Connect your computer with a USB cable to the Arduino microcontroller.
- Open the Arduino software and check what port it is connected to.
- Open the provided Python code and insert the correct port in the document.
- In the same python code set the activation temperature of Phusion polymerase to 98°C and let it run for 60 seconds. Set the cycles: 98°C for DNA denaturation (set the time to 1 second), 63°C to let the primers bind (5 seconds), and 72°C for polymerase to complete the DNA sequence (20 seconds). Repeat this cycle 40 times, keep the final temperature of 72°C for one minute and leave your samples at a refrigerator temperature of 4°C until you are ready to store the samples in the freezer.
- Run the provided Python code on the terminal and see if there are no errors. Terminate the running program by pressing the cntrl+c keys.
- Mount the DremelFuge provided onto the drill.
- Collect some saliva in one of the 1,5 ml Eppendorf reaction tubes provided.
- Add 1,25 µl saliva, 25 µl of Phusion buffer, add 2,5 µl of each the forward and reverse primers, and 17,75 µl distilled water. Finally add 1 µl of Phusion polymerase
- Mix the tube gently and insert into the DremelFuge.
- Add 50 µl of saliva into the remaining empty 1,5 ml tube and insert the tube into the DremelFuge diagonally to the other tube.
- Let the drill spin the DremelFuge for about 2 seconds.
- Take 20 µl of the mix into the 0,5 ml Eppendorf reaction tube.
- Add 10 µl of mineral oil on top.
- Place your Eppendorf reaction tube into a thermocycler and start it by executing the python code provided. The thermocycler will run for about an hour.

For further experimentation, extract DNA from a small piece of skin, the roots of hair, or any meat of a mammal.[23] Instead of Phusion buffer you might want to try a Taq 2x polymerase master mix.[24] Also try using a proper thermocycler[25] and a centrifuge. Be sure that you have the right frequency of revolutions per minute (RPM), which will be mentioned in the documentation provided (Gapševičius, 2019).

*23. Use for example a “DNeasy Blood & Tissue Kit” from Qiagen. Order the kit at https://www.qiagen.com/de/shop/sample-technologies/dna/genomic-dna/dneasy-blood-and-tissue-kit/#orderinginformation (Accessed 4 November 2017).
*24. Order for example at https://www.neb.com/products/m0270-taq-2x-master-mix#Product%20Information (Accessed 2 September 2018).
*25. Get it at eBay or at OpenPCR, available at https://openpcr.org/ (Accessed 2 September 2018).

Experiment 2: Electrophoresis

In this experiment, we will use a gel electrophoresis in order to see if the polimerase chain reaction was successful. The experiment will tell if the LCT gene's regulator was amplified to the sufficient amount in order to proceed with the analysis. For the experiment, we will need:

Samples and chemicals:
- An amplified DNA sample;
- Paraffin or other mineral oil – 10 µl;
- Agarose – 1 g;
- 50 times of TAE buffer – 4 ml;
- Distilled water – 200 ml;
- SERVA DNA Stain G – 1,5 µl;
- 100 base pairs DNA ladder – 5 µl;
- 6 times of coloring dye – 2 µl.

Equipment:
- An empty Eppendorf 0,5 ml tube;
- A power supply;
- A gel electrophoresis chamber;
- A 1-to-10 µl pipette;
- Pipette tips – 5 units;
- An Electric stove or a microwave;
- A knife;
- A 200 ml glass flask;
- A UV light;
- A filter for the UV light;
- Precision scales.

- For the beginning, prepare a 1 % agarose concentration gel. Pour 100 ml of distilled water into a glass flask, 1 g of agarose, 2 ml of TAE buffer.
- Heat it up until it boils. The agarose should be completely dissolved.
- Pour the agarose solution into the plastic container provided. Wait until it cools down to approximately 60°C. Use the time to wash the glass flask – we will need it again later.
- Add 1,5 µl of SERVA DNA Stain G and mix thoroughly to dissolve it. The SERVA DNA Stain G is needed in order to exhibit the molecules under the UV light.
- Place a plastic comb on the top of the container – it will make wells within the gel. If the comb doesn't hold well, use a paper clip or alternative to attach it to

the side of the container. Wait until your gel thickens. In order to accelerate the process, we will place our container into a fridge.
- Take the container out of the fridge and cut approximately 2 cm of the gel next to the shorter sides of the plastic container provided. Throw out the cut-outs.
- Place the electrodes into the cut-outs (Fig. No. 9.) and attach the wires to the power supply. Attach the red wire of the electrode to the yellow wire of the power supply provided and the black wire to the blue wire of the power supply. This combination will output 24 V of electric potential. Do not turn on the power supply yet!

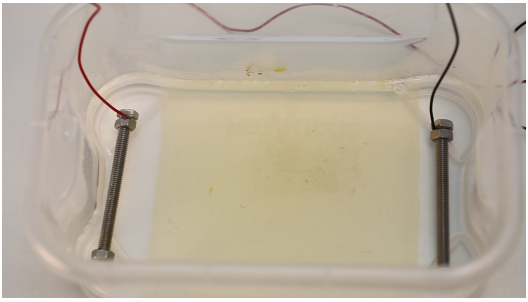

Fig. No. 9. Placed electrodes in the cut-outs of the gel. Photo: Brigita Kasperaitė.

- Pour 100 ml of distilled water into a glass flask and add 2 ml of the TAE buffer. Pour the buffer on top of the gel. Be sure that the buffer floods the electrodes and the gel.
- Pipette 5 µl of the DNA ladder into one of the gel pockets.
- Take an Eppendorf tube with a DNA sample and carefully take 5 µl of the sample. Pipette into a new Eppendorf tube. Add 2 µl of the coloring dye. Mix the solution gently.
- Pour the solution into a well of the gel next to the DNA ladder.
- Turn on the power supply and let the electric potential flow through the chamber for about 40 to 50 minutes.
- Inspect the results with the UV light. You might need a filter in order to see the fluorescent molecules. The fluorescent molecules of your result should be concentrated next to the measurement with 370 base pairs of the 1 kb DNA ladder (Fig. No. 10).

For further experimentation, use ethidium bromide for DNA detection in a gel, a 40% glycerol instead of coloring dye, and a different percentage of agarose. Run electrophorese with different power supply and at different time lengths. For precise results, try also using a proper electrophoresis chamber (Gapševičius, 2019).

Experiment 3: DNA Fingerprinting

DNA fingerprinting is a similar method to the previous one, except for the additionally added restriction enzymes, which cut DNA at specific sequences. This experiment will look at a single nucleotide mutation in a LCT gene's regulator. There are additional steps at the beginning and at the end of the experiment. In order to run the experiment we will need:

Samples and chemicals:
- An amplified DNA sample with the paraffin oil on top;
- Paraffin or other mineral oil – 10 µl;
- Agarose – 2 g;
- 50 x TAE buffer – 4 ml;
- Distilled water – 200 ml;
- SERVA DNA Stain G – 1,5 µl;
- 20 base pairs DNA ladder – 5 µl;
- 6 times of coloring dye – 2 µl;
- A restriction enzyme – 1 µl;
- 10 times of NEB buffer – 2 µl;
- Distilled water – 7 µl.

Equipment:
- An empty Eppendorf 0,5 ml tube;
- A thermocycler with a power supply and an Arduino microcontroller;
- A computer with the Arduino and Python 3 software preinstalled;
- A Python script to control a thermocycler;
- A gel electrophoresis chamber;
- A 1-to-10 µl pipette;
- Pipette tips – 5 units;
- An electric stove or a microwave;
- A knife;
- A 200 ml glass flask or an alternative;
- UV light;
- A filter for the UV light;
- Precision scales.

*30. For details, see protocol at https://openwetware.org/wiki/Preparing_chemically_competent_cells (Accessed 4 November 2017).

- To begin with the experiment, connect the thermocycler with the Arduino in order to control it, and connect the power supply to provide voltage to it.
- Connect your computer with a USB cable to the Arduino microcontroller.
- Set the temperature cycles in the python code so it incubates the sample. In order to do so, we will set the start temperature at 37°C and let it run for more than an hour. Leave the rest code untouched.
- Take an Eppendorf tube with a DNA sample and carefully take 10 µl of the sample. Pipette it into a new Eppendorf tube.
- Take a new tip and add to the sample 2 µl of NEB buffer.
- Add 1 µl of the restriction enzyme to the solution.
- Add 7 µl of the distilled water to the solution. Mix gently.
- Add 10 µl of the paraffin oil to the solution.
- Place the Eppendorf tube into the thermocycler and run the Python code provided in the terminal. After one hour, terminate the running program by pressing the cntrl+c keys.
- Proceed with the steps described in experiment number 2.
- Inspect the results with the UV light. You might need a filter in order to see the fluorescent molecules. The fluorescent molecules of your result should be concentrated next to the different measurements with up to 50 base pairs of the 1 kb DNA ladder (Fig. No. 10) (Gapševičius, 2019).

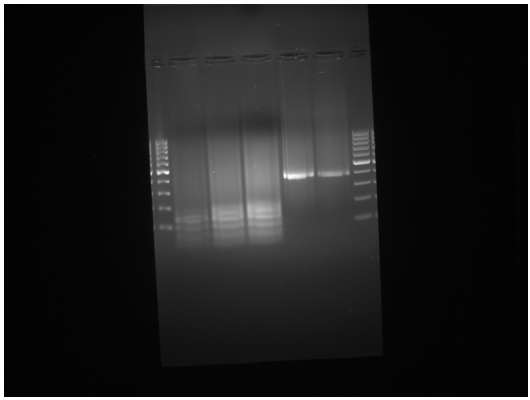

Fig. No. 10. Gel electrophoresis and DNA fingerprinting. In our experiment we used a 2% agarose gel with 1 kb base pairs DNA ladder, located on the left and on the right sides of the gel. The first, second, and third tracks are loaded with the treated DNA samples, with 20, 30, and 50 µl of the sample, respectively. The fourth and fifth tracks are loaded with the untreated DNA sample: in the fourth track the sample was amplified with the professional PCR, and the fifth with the DIY PCR provided in the toolkit. Photo: Auksė Gaižauskaitė.

Conclusions and Discussion

While referring to mythological hybrids, artistic, and scientific projects, this paper aimed to provide a framework for experiencing life at a molecular level. Practical experimentation should have opened up space for dreaming and imagination. For example, I discovered that cloning mammals that sexually reproduce requires a donor organism. In theory, there is the possibility to clone oneself without having a donor organism. In this case the imagined condition would be a manipulated cell from the same female mammal, as only a female mammal would be able to deliver an offspring. Yet another idea would be the modification of an offspring's DNA code with a GFP gene. While in a casual setting the offspring would not differ from a non-modified offspring, under a UV light it would potentially glow.

There are many questions still to be raised and answered, including those that concern ethical issues: How will genetically modified humans share their lives with non-modified ones? Why would I need to clone myself, and how to make sense out of cloning humans? Whatever the answers, the process of genetically modifying humans has already begun,[26] and humans will need to learn how to interact with non-human humans.

The other challenge is the use of DIY tools and experiments in private homes. If the genetic modification of organisms is such a simple process, how does one remain responsible for the produced clones and transgenic organisms?

*26. See MIT Technology Review on China's CRISPR twins. Available at https://www.technologyreview.com/s/613007/chinas-crispr-twins-a-timeline-of-news (Accessed: 16 April 2019).

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This project is part of the *Introduction to Posthuman Aesthetics* project, which proposes a subjective perspective on discourses and experiences in contemporary aesthetics. The discourse introduced in the project and the toolkit invite the reader and toolkit user to experience and to critically evaluate the cloning of animals, including humans.

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