

Muscle tissue bio reactor

A Muscle tissue bio reactor in which implantable intercostal muscles can grow. This is done by stimulating the muscle with electrical and mechanical stimulation. First the muscle cells are mixed in with a hydrogel. This hydrogel is then stored inside a chamber. This chamber is then heated. The cells are stimulated and the motors start pushing and rotating. Eventually the muscle cells will attach themselves to the anchors.

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Context of use: Education
Level of education: Bachelor

Technology Impact Cycle Tool

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Impact on society

What impact is expected from your technology?

This category is only partial filled.

What is exactly the problem? Is it really a problem? Are you sure?

This technology wants to create an opportunity for hospitals to grown artificial muscle implants from muscle cells, with immune data, directly sampled from a patient. When people lose a muscle/muscular function, they can either get a prosthesis or look for a donor. Movement of a prosthetic is clunky. Donors require genetic matching and immune supressing drugs to prevent rejection. These muscles will have the DNA of a patient so they won't be rejected.

Are you sure that this technology is solving the RIGHT problem?

This question has not been answered yet.

How is this technology going to solve the problem?

This question has not been answered yet.

What negative effects do you expect from this technology?

This question has not been answered yet.

In what way is this technology contributing to a world you want to live in?

This question has not been answered yet.

Now that you have thought hard about the impact of this technology on society (by filling out the questions above), what improvements would you like to make to the technology? List them below.

This question has not been answered yet.

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Hateful and criminal actors

What can bad actors do with your technology?

This category is only partial filled.

In which way can the technology be used to break the law or avoid the consequences of breaking the law?

People can include toxins/viruses/foreign objects into the muscle that can deteriorate the health of a patient. People can create cell samples with patient's DNA data & leave this on crime scenes. People can lie about failed samples, falsify test data and have a bad sample be implanted into a human host.

Can fakers, thieves or scammers abuse the technology?

This question has not been answered yet.

Can the technology be used against certain (ethnic) groups or (social) classes?

This question has not been answered yet.

In which way can bad actors use this technology to pit certain groups against each other? These groups can be, but are not constrained to, ethnic, social, political or religious groups.

This question has not been answered yet.

How could bad actors use this technology to subvert or attack the truth?

This question has not been answered yet.

Now that you have thought hard about how bad actors can impact this technology, what improvements would you like to make? List them below.

This question has not been answered yet.

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Privacy

Are you considering the privacy & personal data of the users of your technology?

This category is only partial filled.

Does the technology register personal data? If yes, what personal data?

Yes, this technology registers one's genetic data. It requires doctors to extract stem cells + immune data and Laboratory Assistants to cultivate these cells into a petri dish and mix this with a hydrogel. It also requires the operators to know patient data, as they'll have to know which muscle has to be replaced.

Do you think the technology invades the privacy of the stakeholders? If yes, in what way?

This question has not been answered yet.

Is the technology is compliant with prevailing privacy and data protection law? Can you indicate why?

This question has not been answered yet.

Does the technology mitigate privacy and data protection risks/concerns (privacy by design)? Please indicate how.

This question has not been answered yet.

In which way can you imagine a future impact of the collection of personal data?

This question has not been answered yet.

Now that you have thought hard about privacy and data protection, what improvements would you like to make? List them below.

This question has not been answered yet.

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Human values

How does the technology affect your human values?

This category is only partial filled.

How is the identity of the (intended) users affected by the technology?

With this technology, medical officers will allow to help people who have lost function of a muscle and have this be restored in a way that won't require immune suppressants. This will influence patient's: (bodily) autonomy, self perception, feelings of helplessness, ability to integrate with society, ability to function in the workforce and feelings of security. It could have a negative effect on donors who *want* to donate a muscle of theirs.

How does the technology influence the users' autonomy?

This question has not been answered yet.

What is the effect of the technology on the health and/or well-being of users?

This question has not been answered yet.

Now that you have thought hard about the impact of your technology on human values, what improvements would you like to make to the technology? List them below.

This question has not been answered yet.

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Stakeholders

Have you considered all stakeholders?

This category is only partial filled.

Who are the main users/targetgroups/stakeholders for this technology? Think about the intended context by answering these questions.

Name of the stakeholder

Laboratory Assistants

How is this stakeholder affected?

-

Did you consult the stakeholder?

No

Are you going to take this stakeholder into account?

No

Name of the stakeholder

Doctors

How is this stakeholder affected?

-

Did you consult the stakeholder?

No

Are you going to take this stakeholder into account?

No

Name of the stakeholder

Patients

How is this stakeholder affected?

-

Did you consult the stakeholder?

No

Are you going to take this stakeholder into account?

No

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Name of the stakeholder

Hospitals

How is this stakeholder affected?

-

Did you consult the stakeholder?

No

Are you going to take this stakeholder into account?

No

Name of the stakeholder

Medical Regulation Services

How is this stakeholder affected?

-

Did you consult the stakeholder?

No

Are you going to take this stakeholder into account?

No

Name of the stakeholder

Dutch Board of Human Medical Experimentation

How is this stakeholder affected?

-

Did you consult the stakeholder?

No

Are you going to take this stakeholder into account?

No

Name of the stakeholder

Surgeons

How is this stakeholder affected?

-

Did you consult the stakeholder?

No

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Are you going to take this stakeholder into account?

No

Name of the stakeholder

Investors

How is this stakeholder affected?

-

Did you consult the stakeholder?

No

Are you going to take this stakeholder into account?

No

Name of the stakeholder

Registered donors

How is this stakeholder affected?

-

Did you consult the stakeholder?

No

Are you going to take this stakeholder into account?

No

Name of the stakeholder

Organ Donor Register

How is this stakeholder affected?

-

Did you consult the stakeholder?

No

Are you going to take this stakeholder into account?

No

Did you consider all stakeholders, even the ones that might not be a user or target group, but still might be of interest?

-

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Now that you have thought hard about all stakeholders, what improvements would you like to make? List them below.

This question has not been answered yet.

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Data

Is data in your technology properly used?

This category is only partial filled.

Are you familiar with the fundamental shortcomings and pitfalls of data and do you take this sufficiently into account in the technology?

The team that makes the proof of concept does not have the budget to buy the chemicals required for muscle cultivation, nor do they have access to the equipment required to work with actual stem cells. The team also cannot manufacture a component that is able to keep the culturing environment in check. Thus it can't be verified that the muscles are able to stay alive. Thus all data regarding the cells is based on hypotheses that need to be verified by biomedical engineers.

How does the technology organize continuous improvement when it comes to the use of data?

This question has not been answered yet.

How will the technology keep the insights that it identifies with data sustainable over time?

This question has not been answered yet.

In what way do you consider the fact that data is collected from the users?

This question has not been answered yet.

Now that you have thought hard about the impact of data on this technology, what improvements would you like to make? List them below.

This question has not been answered yet.

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Inclusivity

Is your technology fair for everyone?

This category is only partial filled.

Will everyone have access to the technology?

This question has not been answered yet.

Does this technology have a built-in bias?

It is assumed that hospitals actually have the space for this equipment and that they can include these machines into their energy grid. It is also assumed that this project will be a better alternative than pig grown human muscles as it does not require the slaughter of an animal. There's a risk for a confirmation bias due to the limited knowledge on muscle cell culturing. Muscle cell data also can't be verified.

Does this technology make automatic decisions and how do you account for them?

This question has not been answered yet.

Is everyone benefitting from the technology or only a a small group?

Do you see this as a problem? Why/why not?

This question has not been answered yet.

Does the team that creates the technology represent the diversity of our society?

This question has not been answered yet.

Now that you have thought hard about the inclusivity of the technology, what improvements would you like to make? List them below.

This question has not been answered yet.

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Transparency

Are you transparent about how your technology works?

This category is only partial filled.

Is it explained to the users/stakeholders how the technology works and how the business model works?

The users will receive a detailed guide on how the cells should be inserted into the machine and how the muscle should be removed from the chamber. Without this, the machine can be destroyed. Stakeholders will be referred to stem cell culturing fluid suppliers. Investors, medical regulation services and hospitals will receive detailed instructions along with preliminary results. Surgical transplantation method for grown muscles isn't known.

If the technology makes an (algorithmic) decision, is it explained to the users/stakeholders how the decision was reached?

This question has not been answered yet.

Is it possible to file a complaint or ask questions/get answers about this technology?

This question has not been answered yet.

Is the technology (company) clear about possible negative consequences or shortcomings of the technology?

This question has not been answered yet.

Now that you have thought hard about the transparency of this technology, what improvements would you like to make? List them below.

This question has not been answered yet.

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Sustainability

Is your technology environmentally sustainable?

This category is only partial filled.

In what way is the direct and indirect energy use of this technology taken into account?

The proof of concept is made on a budget. It will have an Arduino, simple motors, minimal sensors, no environment regulation unit, a budget pump and low run times. With the current budget and project scope, the team can not say with certainty what the direct and indirect energy use of the ideal and complete tissue bioreactor will be. This will have to be reviewed by a team with a larger budget.

Do you think alternative materials could have been considered in the technology?

This question has not been answered yet.

Do you think the lifespan of the technology is realistic?

This question has not been answered yet.

What is the hidden impact of the technology in the whole chain?

This question has not been answered yet.

Now that you have thought hard about the sustainability of this technology, what improvements would you like to make? List them below.

This question has not been answered yet.

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Future

Did you consider future impact?

This category is only partial filled.

What could possibly happen with this technology in the future?

There could be a decreased need for donors. Patients could gain easier access to muscle replacements. Recovery plans can become less invasive due to the reduced need for immune suppressing drugs. There will be ethical concerns in religious communities such as Jehovah's Witnesses, which can cause people to create an alternative technology that won't require human or animal based cells.

Sketch a or some future scenario (s) (20-50 years up front) regarding the technology with the help of storytelling. Start with at least one utopian scenario.

This question has not been answered yet.

Sketch a or some future scenario (s) (20-50 years up front) regarding the technology with the help of storytelling. Start with at least one dystopian scenario.

This question has not been answered yet.

Would you like to live in one of this scenario's? Why? Why not?

This question has not been answered yet.

What happens if the technology (which you have thought of as ethically well-considered) is bought or taken over by another party?

This question has not been answered yet.

Impact Improvement: Now that you have thought hard about the future impact of the technology, what improvements would you like to make? List them below.

This question has not been answered yet.