Information on Data Processing and Declaration of Consent

iGEM Munich 2025 values your privacy and processes your personal data in compliance with the EU General Data Protection Regulation (GDPR). Your Personal Data is any information related to you. Processing is any operation performed on the data. According to the Transparency Principle, this document will provide you with information about the processing of your personal data as required by Art. 12, 13, and 14 of the GDPR.

Who are we and how can you contact us?
Name: iGEM Munich 2025
Address: Boltzmannstr. 11 85748 Garching b. München, Germany
E-mail: team@igem-munich.com

Your data will be processed within the iGEM Munich 2025 project (hereinafter: the project). The main aim of this survey is to understand public perceptions of bio-based tattoos, focusing on our project's safety and applications. This will help us refine our Human Practices strategies for future development. To learn more about the iGEM Munich 2025 project, please see https://igemmunich.mwn.de. Please be informed that your data may also be used in different research projects in the domain of Synthetic Biology in accordance with the GDPR.

The following types of information about you are collected and processed within the project: Age, Gender, Use of Medical Devices, Tattoos.

The data are collected directly from you through an online survey.

Legal basis for the processing of your data

Your data is processed on the basis of your consent (Art. 6.1(a) of the GDPR) which you give by accepting this notice. Exceptionally, where consent is not an appropriate legal basis, your personal data can also be processed on the basis of our legitimate interest in carrying out the project, or further research in the field of Synthetic Biology. Then, the processing is based on Art. 6.1(f) of the GDPR.

Your data will be stored for as long as necessary for the fulfillment of the defined research purposes. Your personal data will not be shared with or disclosed to anyone outside the Munich Institute of Biomedical Engineering. Your data will not be transferred outside the European Economic Area. Your data will not be used for profiling or automated decision-making purposes.

The GDPR grants you certain rights with regards to the processing of your personal data. These rights include:

- Access (Art. 15 of the GDPR): you have the right to obtain confirmation as to whether We have your personal data, as well as information about how We process it. You can also request a copy of your personal data, for which We may charge you a reasonable fee based on administrative costs. In order to exercise your right of access, contact us at team@igem-munich.com;
- Rectification (Art. 16 of the GDPR): if your personal data that We process are incomplete or inaccurate, you have the right to request rectification of such data without undue delay. In order to exercise your right to rectification, contact us at team@igem-munich.com;
- Erasure ("right to be forgotten" – Art. 17 of the GDPR): in certain circumstances (e.g. if your data are processed unlawfully or unnecessarily) you may request erasure of your personal data.
- Restriction of processing (Art. 18 of the GDPR): in certain circumstances (e.g. if you contest accuracy of your data that we process or lawfulness of the processing) you may request restriction of processing of your data. Such data will not be erased, but in principle can only be processed with your consent;
- Data portability (Art. 20 of the GDPR): in certain circumstances, you may request transmission of your data to another controller in a structured, commonly used and machine-readable format;
- Right to object (Art. 21 of the GDPR): if you did not consent to the processing, or if it is not necessary to comply with a legal obligation, you may always object to it, in which case We shall no longer process your data.

Moreover, you have the right to withdraw your consent to the processing of your personal data at any time (Art. 7(3) of the GDPR) by contacting us at team@igem-munich.com. The withdrawal of consent will not affect the lawfulness of processing based on consent before its withdrawal; lodge a complaint with a supervisory authority.

Personal Data

What gender do you identify as?

- ☐ Female
- ☐ Male
- ☐ Non-binary / Third gender / Gender diverse
- ☐ Prefer not to say
- ☐ Other

What is your age?

☐ Under 18
☐ 18–24
☐ 25–34
☐ 35–44
☐ 45–54
☐ 55–64
☐ 65 or older

Have you ever used any wearable health or medical device to monitor your health?
(Examples: fitness tracker or smartwatch, continuous glucose monitor, blood pressure monitor, etc.)

☐ Yes, I currently use one or more
☐ Yes, I have used such devices in the past
☐ No, I have never used a health monitoring device
☐ Not sure / Prefer not to say

How would you describe your general attitude toward traditional tattoos?

Likert Scale, 1 is Very Negative and 5 is Very Positive

How familiar are you with the topic of genetic engineering?

- ☐ I have extensive professional experience in genetic engineering.
- ☐ I have moderate knowledge from studies or short-term work in the field.
- ☐ I have basic knowledge of genetic engineering.
- ☐ I have heard of it but know very little.
- ☐ I have no knowledge of genetic engineering.

We want to introduce you to the project our iGEM team is doing this year. Your responses to the upcoming questions are crucial and will help shape the development of our project.

Project Description

Tattoos have long been used as a form of personal expression and art, but can this artistry also serve a functional purpose?

Traditional ink is functional, yet fixed and static, making it unsuitable for advanced dynamic applications. In contrast, every single cell in the body is inherently intelligent, it can sense its environment, communicate with neighboring cells, and respond dynamically to changes in your health. Building on this natural cellular capability, this technology explores a novel concept: a "living tattoo" composed of engineered cells, applied to the skin like a conventional tattoo but with the temporary lifespan of henna.

These engineered cells are specially designed to detect something unusual happening in your body, such as a spike in stress hormones or early signs of infection. Sensing this, the tattoo fades, giving you a visible, real-time signal. Once your body returns to a normal state, the original appearance of the tattoo comes back.

Please, welcome our project about this tattoo technology: ***InkSight***

1. **How likely are you to try this biosensor tattoo?**

☐ **Very Likely** – I would be open to using it and find the concept appealing.
☐ **Likely** – I might consider it for the right application, if the benefit of the information it provides is proportional to the effort of getting the tattoo.
☐ **Unsure** – I would need more information before making a decision
☐ **Unlikely** – I don't think I would use it, due to concerns with the technology
☐ **Completely unlikely** - I would never consider getting any kind of tattoo for aesthetic and/or health-reasons

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In the following section, we introduce comparisons to several existing diagnostic technologies and procedures of various diseases to explore participants' perceptions of how the biosensor tattoo measures up to current solutions

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Many test are performed by drawing a blood sample from a patient. These tests provide very reliable and precise information on the concentration of markers in the bloodstream. A lot of these tests are needed when patients are places under continuous supervision in a clinic.

The biosensor tattoo, by contrast, does not display exact concentrations. Instead, it is designed to detect whether a specific threshold has been surpassed. While this makes the readout less detailed, it allows for continuous monitoring, unlike standard blood testing, which occurs only at discrete intervals (e.g. every week, every six months, etc).

2. **In which situations do you think a biotattoo could be more useful for detecting disease, compared to current methods?** Select all that apply.

- ☐ Monitoring hormone disorders (e.g., thyroid hormone levels)
- ☐ Detecting viral or bacterial infections, post-operative complications, or chronic inflammation
- ☐ Monitoring reactions to medications
- ☐ Monitoring autoimmune diseases (e.g. rheumatoid arthritis)
- ☐ Detecting early signs of cancer relapse
- ☐ None of the above
- ☐ Other

*To monitor **blood glucose levels**, beside pricking the finger, patients with diabetes typically rely on following method:*

***Continuous glucose monitors** - devices about the size of a highlighter cap that are attached to the upper arm. They remain in place for several days and measure glucose levels in the interstitial fluid. Readings are retrieved electronically using a separate reader or smartphone.*

3. **How do you think a real-time, threshold-based biosensor tattoo for detecting <u>glucose levels</u> compares to current methods in terms of usefulness?**

   Likert Scale, 1 is Not useful at all and 5 is Significantly more useful

*While blood analysis can be performed when a condition is suspected, regular tracking of the menstrual cycle is typically done through **mobile apps or by measuring body temperature.***

4. **How do you think a real-time, threshold-based biosensor tattoo for detecting <u>progesterone levels</u> compares to current menstrual cycle tracking methods in terms of usefulness?**

   Likert Scale, 1 is Not useful at all and 5 is Significantly more useful

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In the following section, we would like to investigate common public concerns regarding biosafety.

Safety

The biosensor tattoo uses living mammalian cells, similar to those naturally found in the human body. However, these cells are genetically engineered to produce specific proteins that your body's natural cells do not produce. Such modification enables the cells to perform monitoring functions.

5. **How does knowing that the biosensor tattoo uses mammalian cells affect your perception of its safety?**

- ☐ Very positively - I feel reassured knowing the cells are similar to human cells and are physically contained
- ☐ Somewhat Positively - I like the direction but am not without doubt
- ☐ Neutral - this information does not affect my opinion
- ☐ Somewhat negatively - I have some concerns about the use of genetically engineered cells, even if they are contained
- ☐ Very negatively - I feel extremely uncomfortable with the idea of living or engineered cells being applied to the skin, regardless of safety measures

6. **Without any additional information, how does knowing that the biosensor tattoo uses genetically engineered cells affect your perception of its safety?**

   Likert Scale, 1 is Very Negatively and 5 is Very Positively

Among possible concerns we have identified, immunogenicity is a central one. To avoid recognition as potential danger by immune cells of the human body and prevent the cells from spreading, we have decided to isolate them by embedding in a soft, water-based hydrogel - a material also used in regenerative medicine and wound care.

7. **How does knowing that the biosensor tattoo uses hydrogel affect your perception of its safety?**

   Likert Scale, 1 is Very Negatively and 5 is Very Positively

The goal of this approach is to make application as minimally invasive as possible. However, the monitoring cells would be delivered in the skin using a needle, similar to how conventional tattoos are applied. Depending on individual pain tolerance and the location on the body, the procedure can involve some degree of discomfort or pain.

8. **How acceptable do you find this level of invasiveness?**

   Likert Scale, 1 is Not acceptable at all and 5 is Completely acceptable

The biosensor tattoo would visibly indicate certain health states or changes. This means that, depending on design and placement, not only you but others might be able to see aspects of your health status without your explicit consent.

9. **How concerned are you about the potential loss of privacy related to others seeing your health information?**

   Likert Scale, 1 is Not concerned at all and 5 is Very concerned

As with any diagnostic tool, this technology may occasionally fail to detect a condition or indicate a condition that isn't present. Unlike some other systems, it does not currently have the ability to notify the user if it is malfunctioning or not working properly.

10. How do you feel about this limitation? Select one option.

- ☐ I find this unacceptable and would not consider using the technology without such a feature.
- ☐ I would strongly prefer the system to include a way of indicating malfunctions or loss of accuracy.
- ☐ I am somewhat concerned but would still consider using it if the reliability rate is clinically validated.
- ☐ I'm comfortable with this limitation, as I would follow up with a healthcare provider after any signal regardless.
- ☐ I'm not concerned at all.
- ☐ Other

You are almost ready! Just a couple more questions. This time overall about the technology that we envision as revolutionary in the diagnostics field.

Final Questions

Because this tattoo relies on a contrast between pigmented and faded states, its visibility depends on how well the pigment stands out against a person's natural skin tone.

We have chosen melanin because this pigment is reliably produced in human cells, though it may be less visible on darker skin tones. And while we are actively exploring alternative pigments to improve inclusivity, melanin currently limits inclusivity.

11. How do you feel about this challenge and our current approach? Select one option.

- ☐ I find this unacceptable and would not consider using the technology without such a feature.
- ☐ I would strongly prefer the system to include a way of indicating malfunctions or loss of accuracy.
- ☐ I am somewhat concerned but would still consider using it if the reliability rate is clinically validated.
- ☐ I'm comfortable with this limitation, as I would follow up with a healthcare provider after any signal regardless.
- ☐ I'm not concerned at all.
- ☐ Other

12. Which of the following situations would be a strong enough reason for you to consider trying a biosensor tattoo? Select however many options apply.

- ☐ Chronic condition (e.g., diabetes, cardiovascular disease)
- ☐ Tracking hormones or biological cycles (e.g., menstrual cycle, fertility, stress)
- ☐ Acute or recovery-related needs (e.g., post-surgery, injury recovery)
- ☐ Supporting fitness or athletic performance
- ☐ Preventive health and early detection
- ☐ For use in a specific profession (e.g., military, healthcare, high-risk environments)
- ☐ Aesthetic reasons (tattoo)
- ☐ None
- ☐ Pure curiosity
- ☐ Other

13. Now, being at the end of our survey, we are going to ask again: How likely are you to try this biosensor tattoo?
Please note: This question does not refer to testing an experimental device, but rather explores your general acceptance of such a technology if it were ever fully developed and approved for use.

☐ **Very Likely** – I would be open to using it and find the concept appealing.
☐ **Likely** – I might consider it for the right application, if the benefit of the information it provides is proportional to the effort of getting the tattoo.
☐ **Unsure** – I would need more information before making a decision
☐ **Unlikely** – I don't think I would use it, due to concerns with the technology
☐ **Completely unlikely** - I would never consider getting any kind of tattoo for aesthetic and/or health-reasons

14. Do you have any additional comments, questions, or concerns about the biosensor tattoo or this survey? Please share any thoughts you'd like us to consider.

Open-ended question.