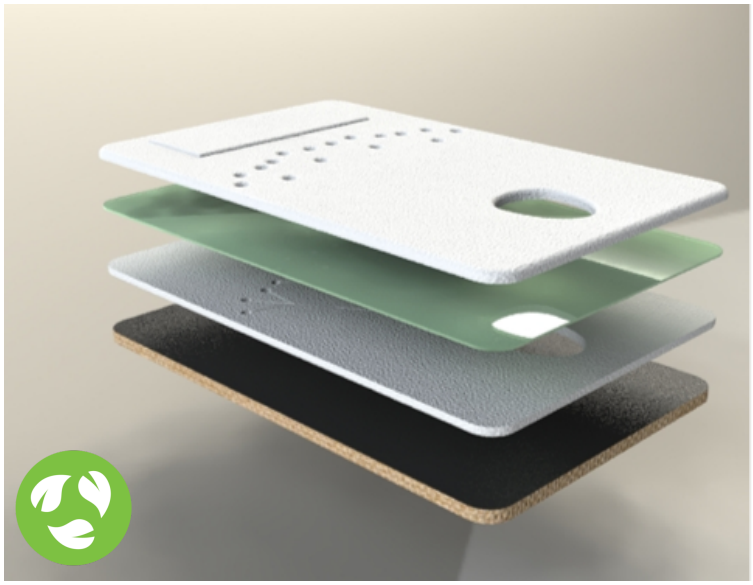
We present iGEM Rotterdam 2020

iGEM
Rotterdam 2020

The iGEM Rotterdam 2020 Team consists of enthusiastic students from the educational programs Biology and Medical research, Industrial product design and Informatics. For our project, we hope to support the available medical care. Therefore we hope to recruit sponsors to help to attain our goals and what will help us to participate in the iGEM 2020 competition!

We are developing a low-cost and flexible detection system for health-related real-world problems, the Health Risk Detection kit. This kit will bring a fast and reliable point-of-care testing solution for people who have a need for fast medical care at home or at the bedside. This will improve health care for many different social groups that depend on home care. Our project will mainly focus on current deceases such as COVID-19, to prevent intensive hospital visits but will also lighten work load for district nurses and midwives in their care of the home-bound.

The iGEM Foundation wants us to think beyond te lab during our project. With this in our mind during our project we would like to take te environmental health into account. This is why we have decided to look at the amount of waste we produce in the wet lab when developing our product as well as looking at the waste our product will produce. As a result of this we will minimize te amount of waste by making our product completely biodegradable.



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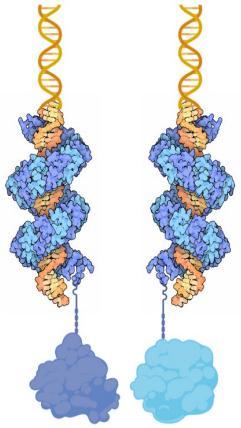

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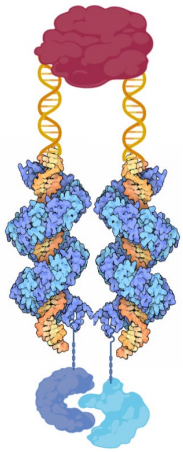


←Target

←Aptamer region (DNA)

←Protein binding region (DNA)

←TALE (DNA binding region; protein)

←TEV protease region (protein)

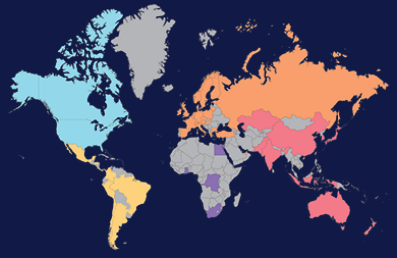
iGEM 2020

Our research goal

Empowering low-cost solutions for health-related real-world problems, in particular fast and reliable point-of-care testing.

The iGEM competition

An annual, world wide synthetic biology event aimed at undergraduate university students, as well as high school and graduate students. The iGEM Competition gives students the opportunity to push the boundaries of synthetic biology by tackling everyday issues facing the world. Multidisciplinary teams work together to design, build, test, and measure a system of their own design using interchangeable biological parts and standard molecular biology techniques. iGEM teams work inside and outside the lab, creating sophisticated projects that strive to create a positive contribution to their communities and the world. Every year nearly 6,000 people dedicate their summer to iGEM and then come together in the fall to present their work and compete at the annual Giant Jamboree (2).



The aim is to address this by designing an enzyme cascade-based assay combined with a mobile phone read-out: the Health Risk Detection Kit.

Our project consists of two stages: developing a fool proof detection method and developing a simple read-out method by means of a conductivity change.

In the first stage of development of this assay we will construct a detection method for a variety of disease targets, ranging from nucleic acids to proteins and other (macro)molecules. The detection part will consist of two DNA-protein complexes. Two double stranded DNA's will consist of an aptamer region and a protein binding region. Aptamers are oligonucleotide (DNA) molecules that bind to a specific molecule. Both proteins will contain a DNA binding region and one of two halves of the enzyme TEV (Tobacco Etch Virus).

The DNA binding regions contain TALE (transcription activator-like effectors) DNA binding units that are designed to specifically bind one of the two DNA modules. Secondly the proteins will contain either the N-terminal or the C-terminal half of the TEV enzyme (protease). The two TEV halves become enzymatically active when brought to close proximity. The technique is called the split TEV technique (1).

Since both halves of split TEV (NTEV and CTEV) only bind to one of the two different DNA molecules, they are forced together only when both aptamers bind the same target molecule, forming the active TEV protease. TEV protease activates a second enzyme (cellulase) by cleaving off an inhibitory tag. Cellulase activates the read out system.

The system is adaptable: target switching occurs by simply changing the aptamers.

References:
1: Wehr, Michael C; Laage, Rico; Bolz, Ulrike; Fischer, Tobias M; Grünewald, Sylvia; Scheek, Sigrid;Bach, Alfred; Nave, Klaus-Armin; Rossner, Moritz J (2006). "Monitoring regulated protein-protein interactions using split TEV". Nature Methods. **3** (12): 985–93. doi:10.1038/nmeth967. PMID 17072307.
2: iGEM foundation (2020) International Genetically Engineered Machine Competition, https://igem.org/Competition