The Problem:

It’s well known that microplastics have become a real concern in water systems for biologists around the world, however, other micropollutants also challenge water treatment plants. Drug ingredients such as diclofenac are in common use in pain relieving ointments due to the anti-inflammatory and pain-relieving properties, as well as the advantage of local use. This makes it very popular with doctors and patients.

Due to overuse, diclofenac accumulates in wastewater and thus contaminates the environment. The current treatment in sewage plants is expensive and complex. Our vision is to make this process efficient and inexpensive through genetic engineering.

Together we want to create a cleaner, healthier environment.

Our project involves the modification of the green algae *Chlamydomonas reinhardtii*, enabling the chemical modification of diclofenac resulting in its functional degradation.

The Plan:

We will integrate genes for the enzyme Laccase into the genome of our green algae. This will facilitate the production of these enzyme and secretion into medium (the wastewater from wastewater treatment plants), where they can then break down diclofenac.

To ensure an efficient enzyme production, *Chlamydomonas* will be raised as a permanent culture in a bioreactor. To separate the green algae from the wastewater, we want to create a filter between the bioreactor and the wastewater basin that only allows the enzymes to pass through. The degradation products show no toxicity and therefore do not harm the environment.

*Chlamydomonas* was chosen as an enzyme factory due to it being a well-studied and harmless model organism. Moreover, its production of high amount of proteins makes it perfect for our concept. The previous year’s team has already utilized this organism to break down PET and MHET microplastics as an environmental screening tool. Our vision is to create an organism with *Chlamydomonas reinhardtii* that is able to break down many different micropollutants from wastewater to optimize the process.

Even if neither *Chlamydomonas* nor integrated genes pose a threat to humans and the environment, we want to make sure that it cannot survive outside of our laboratory. For this purpose, a kill-switch will be inserted into the green algae, which prevents its survival in the wild.