Pilot study: Surveying Complex Samples for Synthetic Elements by Targeted Enrichment

Biological weapons have been utilized long before humanity's ability to genetically engineer microorganisms. The timeline goes something like; Dip arrowheads in poison, weaponize the plague and in modern times, genetically engineered microorganisms to become even more lethal. In this new age of bioengineering, we can no longer rely on the fact that mean-sounding microorganisms are more dangerous than others, such as anthrax (popularized by anthrax mail attacks of 2001). Instead, we need to look deeper at the genes that make some microorganisms dangerous. Any ordinary virus or bacteria can now potentially be weaponized by introducing genes leading to increased virulence or antibiotic resistance. An aspect of biological weaponry that is a bit more subtle than dropping toxic bombs, is poisoning the water supply or introducing antibiotic resistances that become increasingly more difficult to combat. In this project, we try to get one step closer to identifying synthetic microorganisms, using a technology called *targeted enrichment* or *in-solution hybridisation.* This is a well-suited method for the task, as the signs of genetic intrusion may be subtle and drowned in the background noise generated by the remainder of the genetic sequences. Targeted enrichment is a method of *fishing* for sequences of interest. We started the project by defining what we are fishing for. We realized we should be looking for the vectors of genetic engineering. These are the rockets carrying the payload, if you will. If we can identify the rockets, perhaps we can also find the payloads. After having designed our fishing baits, we went to the lab and started fishing. After applying our method, we found that the baits caught something. By bioinformatically analysing the captured sequences, we found that some microorganisms were enriched hundreds of times their initial concentration. This pilot project was a success since we have established a baseline performance for an unoptimized bait panel. Scientists can now further the project by improving the baits and/or testing different experiments using our bait panel to further characterize its efficiency.