IGEM McGill: Synbiosis Art Contest – Inspiration Material

There are a lot of online resources where you can learn some more about really cool things going on with synbio. But don't worry! If you're not too familiar with some concepts in biology or in biotech, here's a quick guide with resources to easily grasp the essence of synbio and its advancements.

In case you didn't know, the three important entities that are the focus of engineering with synthetic biology are **DNA, RNA, and proteins**.

These are connected through a fundamental process applicable to all living cells, called the *central dogma*, and so it's a natural and inevitable tool in synthetic biology. Here is a nice explanatory 3D animation on the central dogma.

At the beginning, synthetic biology was, and still is largely about engineering living cells by manipulating their DNA. This allows to get some new desired functions from these organisms, whether it be scaled-up biosynthesis of a compound of interest, redesigning proteins, or bio-sensing capabilities. The tools we use to achieve this, like the CRISPR-cas9 gene editing technique, are foundational to the field of synthetic biology. Here are a few resources on this vast topic:

- *3D animation of how CRISPR-cas9 works*, and applications – link here
- *Harnessing synthetic biology for controlled bio-production by living cells* – link here
- *A nice introduction to genetic circuits* – link here

More recently, synthetic biology has expanded to look at how non-living things derived from biology can be used to give rise to new bio-molecular machines. These don't necessarily exist in nature, but serve new purposes, such as targeted drug delivery or enhanced bio-manufacturing. Here are a few of the main advances with links:

- One of the main advances in this domain is **DNA origami** (it is what it sounds like!). Here are two short videos on how it works and how it can be used – link 1 here, link 2 here, link 3 here.

- **Storing digital data** is an essential part of everyday life, and of course, for society. It is estimated that the amount of data to be stored by 2025 is around 3.3 zettabytes, which is incredibly enormous. This will eventually require an overwhelming number of silicon-based capacities associated with high costs and environmental impacts related to silicon extraction and space allocation. DNA presents itself as a promising alternative to this issue, and a far more powerful tool to store data - you can theoretically store the entire world's data in a few grams of DNA! Here are a few interesting links:
    - An inspirational video on DNA storage and computation – link here
    - For those interested, some fun articles on the topic:
        - Scientific American
        - MIT News
        - Harvard Technology

DNA computing is becoming a hallmark of synthetic biology and shows to have potential in being far more powerful than today's silicon-based machines. This video sums it up well.