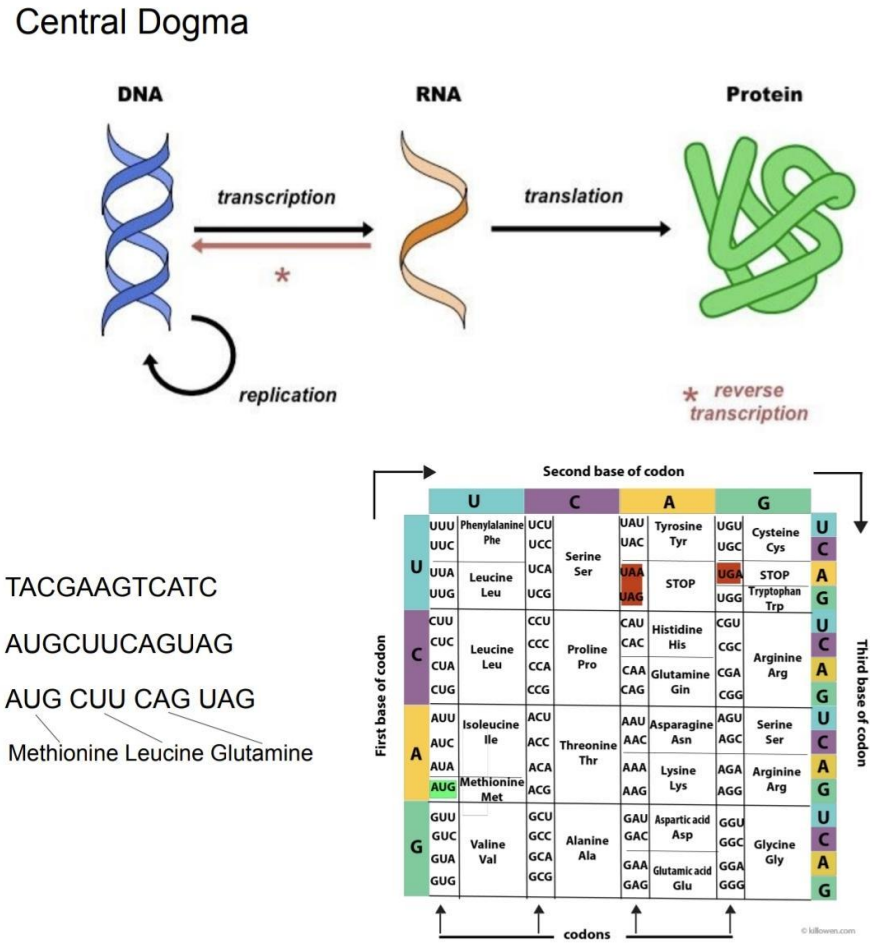
Introduction

Introduce myself and Ali, explain that we are bioengineering students and explain what this means with some examples. Introduce the activity - molecular bioengineering and applying it to design tests and vaccines for covid-19. Gauge their interest in and knowledge level of biology - students had mixed levels of interest in biology, mostly neutral or positive, one very strongly negative.

DNA explanation



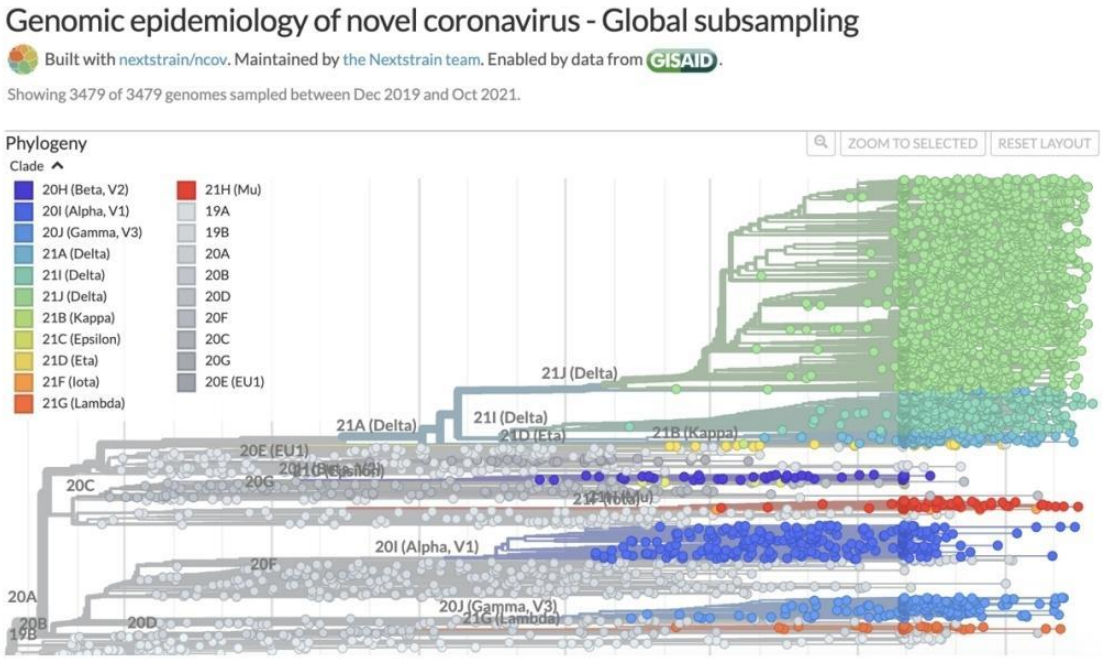
Using the powerpoint, explain from scratch DNA, RNA, nucleotides, complementary base pairing and the central dogma of molecular biology, DNA replication, codons and protein synthesis. Point out the redundancy in codons, and explain how mutations can be helpful or harmful, and how their effects are mitigated by different microbiological mechanisms. Introduce the idea of protein underlying all function. Introduce the concept of PCR and relate to covid tests, and the difference between rapid LFTs and PCR tests. Emphasise the importance of the central dogma in molecular bioengineering.

Engage the students in some exercises to ensure their understanding of complementary base pairing, the concept of codons and of transcription and translation. Students were very

reluctant to raise their hands to engage, but when called upon were able to answer correctly and seemed to have understood the concepts.

Introduce the idea of sequence recognition and primers, and the tenets behind primer design and the relevance of how prone different parts of the genome are to mutations.

Computer lab activity



Direct students to nextstrain.org and invite them to explore different strains, see if they recognise any and achieve the understanding if how frequent mutations are and how many there are. Give them instructions to get to a research paper to emphasise how these concepts and their related technologies lead to real research and real life changes.

Unfortunately we were limited on time, so were unable to have the students use Benchling to explore the covid-19 genome and designing their own primers.

Conclusion

Summarise the activity and the key takeaways about the applicability of molecular bioengineering and the design considerations of biological products and devices, especially in relation to covid-19 tests and viruses. Mention other interesting bioengineering breakthroughs to broaden their understanding of the limits if bioengineering and hopefully get them excited and interested in a field they may not have known existed.

Evaluation of activity

Unfortunately the warm weather and limited time meant that the students were slower to engage than anticipated, and that we did not manage to get through as much of our planned activities as we wanted. We had planned around this possibility, so we were able to explain the most important parts of the activity, and did achieve the goal of introducing students to the idea of bioengineering as a field, and in emphasising its impact on the world, its importance, what concepts underpin it and the critical thinking involved in the work. Students picked up the concepts quickly, and were interested in and engaged in using the computers to explore something that related to covid, which they were very aware of, and to molecular bioengineering, which was a new concept to them.