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Ordered DNA fragmentation using soft lithography and amplification for next generation sequencing

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Next Generation Sequencing (NGS) technology starts with randomly fragmented DNA from whole genomic DNA. Because of this randomness, all DNA fragments need to sequence massive parallel reads in order to know the whole sequencing. In this study, we try to cut DNA fragments into 10-15 kbps using soft lithography technology because one of the NGS platforms is Pacific Biosciences' RS, able to read larger size fragments up to 15 kilo base pairs, quickly. Also, as an ultimate goal, we will try to keep the DNA fragments in the orders from the surface, so the DNA reads do not need to be sequenced several times. In previous studies, we stretched DNA on PMMA (Poly Methyl Methacrylate) substrate and the stretched DNA could be linearly cut with soft lithography by applying DNase I enzyme. After cutting the DNA on the substrate, in order to sequence the DNA fragments with NGS technology, the DNA fragments are taken from the surface and placed in a solution base. We dissolved the PMMA substrate and fragmented DNA fragments together and separated the DNA fragments using a Phenol-Chloroform Isoamyl (PCI) extraction procedure. The principle of separating DNA with PCI mixture is based on solubility differences between organic and aqueous liquids. DNA is a negatively charged, hydrophilic bio-polymer because of its negatively charged phosphate groups. On the other hand, PMMA is a non-charged polymer that is dissolved in chloroform. By dissolving the PMMA surface, it is possible to separate DNA from the surface using liquid-liquid phase separation (organic phase:aqueous phase). For the data processing, confocal microscopy was used to take images of cut DNA on the PMMA surface. Gel electrophoresis and bioanalyzer were conducted to confirm the distribution of the DNA fragments. Finally, PacBio RS II which is the one of the long-read next-generation sequencing platforms was used to confirm quality and quantity of the fragmented DNA from surfaces.

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Continuous Glucose Monitoring (CGM) technologies: An overview

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Diabetes Mellitus is one of the most prevalent metabolic disorders which affect over 300 millions of patients worldwide. Diabetes patients are prone to prolonged period of hyperglycemia or hypoglycemia. If uncontrolled, it can pose serious health complications and extremely large financial burden to the patients and healthcare system. In order to achieve best possible blood sugar control and diabetes management, it is crucial to continuously monitor the blood glucose in addition to the chronical biomarkers such as Hemoglobin A1c. Continuous Glucose Monitoring (CMG) devices has existed for over a decade and is now receiving increasingly more attention from patients and healthcare providers worldwide, thanks to the advancement of sensing technologies as well as communication infrastructures, which allows connected care more feasible than ever before. This presentation serves to provide a technological overview of the commercially available CGM products as well as some of the novel CGM systems undergoing clinical trials. The scope of this overview covers operation principles for each sensing mechanism and will provide a discussion of respective advantages and disadvantages for enzymatic vs. non enzymatic reactions, electrochemical vs. optical sensing and non invasive vs. subcutaneous vs. implantable approaches. The presentation will also comment on the technical challenges faced by today's CGM systems and the future research directions.

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