Demonstration of the Nanopore MinION DNA Sequencer

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ABSTRACT

The Nanopore MinION is a portable and inexpensive instrument that performs rapid DNA or RNA sequencing. The objective of this technology demonstration is to share the workflow, operation, result interpretation, and applications of the sequencer with an emphasis on use for teaching. The principle of nanopore sequencing is based on the continuous threading of nucleic-acid molecules through membrane-bound pores. As DNA passes through the pore, it causes a disruption of electric current that is nucleotide-specific. This allows for long and continuous sequencing reads of DNA or RNA across 512 nanopore channels at a time, generating 30 Gb of data per flow cell. The MinION instrument can fit into the palm of the hand and can be operated with a conventional laptop computer or even a smart phone/tablet when using the MinIT adapter. Data analyses are performed using software provided by Nanopore, or bioinformatic pipelines can be customized by the user. Sequencing of defined targets can be multiplexed using nucleic-acid barcodes during library preparation, which can allow for multiple student samples to be analyzed in a single run. A starter pack can be purchased for $1000, which includes all the materials needed for initial sequencing experiments. The low-capital investment makes massively-parallel next-generation sequencing available to educational programs that are unable to purchase a traditional sequencer. Using the MinION instrument in the classroom is a practical approach for hands-on experience with the technology and applications of massively-parallel next-generation sequencing. Texas Tech University Sciences Center will demonstrate the MinION and share the experience for teaching students in the molecular pathology program.

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