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The Future of DNA Sequencing Technology

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When considering the entire history of science, DNA sequencing is still a relatively new process. Here, we take a quick look at its potential in a few current and developing fields.

Developmental biology

Each of us begins as a single cell and grows into a highly ordered mass of billions of cells. But our knowledge of development is still incomplete. Sequencing-based, scalable single-cell profiling is made possible by recent technology. While ex vivo methods, such as single-cell RNA-seq, are widely used, one unconventional method involves performing RNA or protein sequencing in situ, which preserves the spatial context. Other cutting-edge techniques utilize transport barcodes to catalogue neural connections or in vivo editing of the genome to monitor cell-lineage associations. DNA editing may be used to document biological events more broadly, such as tracking calcium levels or gene expression.

Population scale resequencing

The point at which 0.1% of extant humans will have had some degree of genome resequencing is rapidly approaching, and the process of resequencing the genomes of our ancestors and other human beings is changing our knowledge of human history. The quantity of de novo point mutations that have emerged over the last generations is far higher than the total amount of nucleotides found in the genome of human beings. A nucleotide-level imprint of the human genome could eventually be obtained by combining tens of millions of genomes. Additionally, DNA sequencing is becoming more and more helpful for forensics, since it doesn't always need a specimen from the identified person.

Real-time portable sensors

At present, 70 g nanopore sequencers can produce results 30 minutes after a sample is applied. Dispersed networks of nanopore sequencers could allow for "universal monitoring" of nucleic acids in environmental settings and day-to-day human life, such as fine-grained monitoring of our food, air, and body. Data from millions of equipment could potentially be streamed, and it could integrate with GPS and audio-visual data.

Genome diversity

One eukaryote may be the only one to date to have a 100% complete genome, or a telomere-to-telomere sequencing for every chromosome without any gaps or ambiguities. We are hopeful that we will be able to address difficult portions of more genomes as sequencing methods advance. Every one of the millions of extant and living organisms on Earth has a genome that is just waiting to be sequenced, in addition to the innumerable microbiomes and metagenomes. Unexpected uses for a complete understanding of genetic variation include the establishment of protein structure.

Unconventional uses

It's likely that DNA sequencing technology will be helpful in other, unexpected ways. For instance, vast volumes of data encoded in synthetic DNA have recently been recovered using NGS. Beyond sequencing, nanopores may be employed in the tracking of analyte binding, chemical nanomachines, or the folding and unfolding of proteins.

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