

Fiber Array Sequencing Test Method



Overview

Application note Fiber-seq: High-resolution long-read chromatin The landmark Fiber-seq study from Stergachis et al. (2020) showed it was possible to sequen.

Key Takeaways

Fiber-seq is a single-molecule, long-read sequencing method that maps chromatin structure, DNA methylation, and protein occupancy on individual DNA fibers. Overview

Fiber-seq is a multiomic assay designed to capture both genomic and epigenomic information at single-molecule resolution. Unlike traditional short-read chromatin assays, Fiber-seq simultaneously provides data on DNA sequence, chromatin accessibility, nucleosome positioning, CpG methylation, and transcription factor binding on individual chromatin fibers, enabling haplotype-specific insights into gene regulation and chromatin dynamics .

Key Principles

- **Enzymatic Labeling:** The method uses the non-specific N6-adenine methyltransferase Hia5 to methylate adenines in accessible (unprotected) DNA regions. This 6mA mark is not naturally present in most eukaryotic genomes, allowing clear distinction from endogenous 5mC methylation .
- **Single-Molecule Long-Read Sequencing:** Labeled DNA is extracted and prepared using PacBio SMRTbell library protocols for HiFi sequencing. Each read represents a multi-kilobase chromatin fiber, capturing both the DNA sequence and epigenetic modifications .



- **Protein Footprinting:** Regions where adenines remain unmethylated indicate protein binding, and the size of these unmethylated footprints can infer the type of bound protein .

Workflow

- **Nuclei Isolation:** Cells are harvested, and nuclei are extracted to preserve chromatin structure .
- **Hia5 Methylation Reaction:** Nuclei are incubated with Hia5 and S-adenosylmethionine (SAM) to label accessible adenines with 6mA .
- **DNA Extraction and Library Preparation:** High molecular weight DNA is purified and converted into SMRTbell libraries suitable for PacBio long-read sequencing .
- **Sequencing:** PacBio HiFi sequencing detects both 6mA and endogenous 5mC modifications, generating highly accurate long reads representing individual chromatin fibers .
- **Data Analysis:** Bioinformatic pipelines, such as Fibertools, are used to perform quality control, map methylation and accessibility, and infer regulatory elements and nucleosome positions .

Applications

- **Chromatin Accessibility Mapping:** Identifies open chromatin regions at near base-pair resolution.
- **Epigenetic Profiling:** Simultaneously captures DNA methylation patterns and protein occupancy.
- **Haplotype-Resolved Analysis:** Enables phasing of genetic variants and epigenetic features along individual DNA fibers.
- **Regulatory Element Characterization:** Provides insights into transcription factor binding, nucleosome positioning, and cis-regulatory architecture .

Advantages

- **Single Assay Multiomic Data:** Combines information that would otherwise require multiple separate assays (e.g., WGS, WGBS, ATAC-seq).
- **High Resolution:** Near single-nucleotide resolution on multi-kilobase DNA fibers.
- **Reduced False Positives:** Direct labeling of accessible DNA avoids enzymatic digestion artifacts common in other chromatin assays . Fiber-seq represents a cutting-edge approach in chromatin biology, offering a comprehensive view of genome regulation at the level of individual DNA molecules.

Article Content

Application note Fiber-seq: High-resolution long-read chromatin

The landmark Fiber-seq study from Stergachis et al. (2020) showed it was possible to sequence multi-kilobase individual chromatin

Fiber-seq 101: A Multiomic Assay That Goes Beyond ATAC-seq

New long-read sequencing methods such as Fiber-seq now make it possible to study chromatin with much higher sensitivity than

EpiCypher CUTANA Fiber-seq Protocol

10 minute labeling step, the reaction is quenched and genomic DNA (gDNA) is purified and prepared for sequencing with direct or

Fiber array test method and apparatus

Disclosed is an apparatus for testing an array of optical fibers. According to the invention, modulated light is projected through

Standard Test Method for Length and Length Distribution of Cotton ...

5.1 The array method provides objective measurements for determining the fiber length and length distribution in a

Fiber-seq Service

Leveraging long-read sequencing technology, Fiber-seq can simultaneously reveal chromatin structural and functional differences

Single chromatin fiber profiling and nucleosome position mapping in

We apply a single-molecule chromatin fiber sequencing (Fiber-seq) protocol designed for amplification-free cell-type

Unpacking Chromatin Accessibility with Fiber-seq

Chromatin accessibility has long been used as a marker for regions of DNA with regulatory potential. Fiber-seq

Full article: Fiber Optic Array Biosensors

In addition, living cells can be loaded into the arrays, and their individual responses monitored over long time periods,

DNA Fiber Spreading Assay to Test HDACi Effects on DNA and Its ...

DNA fiber spreading assay is an invaluable technique to visualize and follow the spatial and temporal progress of

Topic: Fiber Optic Cables With Multifiber/Array Connectors

Cables With Multifiber/Array Fiber Optic Connectors and Their Testing Issues Prefab cable systems and parallel array transmission

Fiber Optics IV

The fourth course, Fiber Optics IV - Testing, describes the optical fiber and optical connection laboratory measurements used to

Fiber Testing | Fiber Optic Cable Testing Methods & Top Tools

Fiber testing encompasses the processes, tools, and standards used to test fiber optic components, fiber links, and deployed fiber

Fiber Optic Array Biosensors

Tufts University Medford, MA, USA Optical fiber arrays provide a powerful substrate for creating high-density sensing systems that

Fiber Optic System Testing Tutorial

The passive fiber optic link may include the following components: 1) fiber optic cable, 2) fiber optic connectors, 3) fiber optic

Single chromatin fiber profiling and nucleosome position mapping

Specifically, application of this method enables the resolution of cell-selective promoter and enhancer architectures on single fibers,

Application note Fiber-seq: High-resolution long-read chromatin

Fiber-seq is a powerful new long-read whole genome sequencing assay that overcomes the challenges imposed by short-read

Mapping single-cell diploid chromatin fiber architectures using DAF-seq

Single-molecule chromatin fiber sequencing exposes single-cell-level heterogeneity in the chromatin architecture of

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