



Device for extracting long genomic DNA from human cells

A microfluidic device for automated cell lysis and extraction of long DNA strands.

IP Status: Issued US Patent; **Issued Patent No.** 11,207,679

Applications

- Microfluidics
- DNA extraction

Key Benefits & Differentiators

- **Cell lysis automated:** procedure starts with cells
- **Extracting long DNA** from cells offers better sample for genomics
- **Small sample volume** enabled by microfluidics
- Suitable for **upstream integration**
- **Reduces manual work:** 100ng of long DNA extracted directly from cells with < 5 mins of labor

Microfluidic device to extract long DNA strands

Next-Generation Sequencing (NGS) offers high throughput methodologies to sequence extremely long DNA, thereby making whole genome mapping more rapid and accurate. Key to achieving high quality results with NGS, and long-read technologies in general, is the use of high molecular weight DNA as a starting material. Extracting and purifying long DNA strands, however, has been a challenge. Currently, gel electrophoresis is the standard method to purify long DNA molecules, but the method is time consuming and requires a high initial DNA concentration for purification.

Prof. Kevin Dorfman's research group at the University of Minnesota has developed a device that can lyse cells, remove proteins and small DNA fragments to selectively extract long genomic DNA. First, this microfluidic device uses electrophoresis to lyse cells to extract genomic DNA. Next, long DNA molecules are selectively trapped using entropic traps. Subsequently, pure and concentrated long genomic DNA molecules are produced.

The trapping ability of this short-pass filter can be tuned by optimizing the strength of the electric field at the interface and the relative height of nanoslit to the size of the DNA. This tunable short-pass filter system provides an efficient alternative for gel electrophoresis for sample preparation of rare long DNA molecules. This microfluidic device not only expedites sample preparation, but also offers the opportunity for integration with genomics technologies to eliminate DNA fragmentation and loss during transfer to the genomic device. The technology is fast, easy to implement and can be applied to any cell type. The technology greatly simplifies the long DNA extraction process, expediting which could expedite the entire DNA sequencing process.

Phase of Development

TRL: 3-4

Proof of concept device developed. Researchers have demonstrated this device could lyse cells,

Technology ID

20180033-20180254

Category

Engineering & Physical
Sciences/Design Specifications
Engineering & Physical
Sciences/Instrumentation,
Sensors & Controls
Life Sciences/Human Health
Life Sciences/Research Tools

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concentrate rare genomic DNA samples and remove impurities.

Desired Partnerships

This technology is now available for:

- License
- Sponsored research
- Co-development

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Researchers

- [Kevin Dorfman, PhD](#), Professor, Chemical Engineering and Material Science

References

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<https://doi.org/10.1021/acsomega.0c01912>
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