

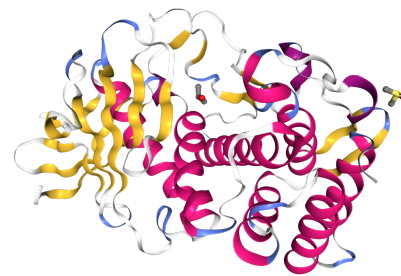
Efficient DNA Extractions for CRISPR Toolkits

A Simplified CRISPR Genotyping Workflow

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MicroGEM's *prepGEM*
structure model

Introduction

For CRISPR genotyping to be successful, adequate DNA must be available for the downstream analysis. Extraction methods with poor DNA recovery, such as magnetic bead and silica-column based approaches, lose DNA during the extraction process. Therefore, large numbers of cells are required as a starting sample to extract enough DNA. As a result, labs must grow cells for longer. It is not uncommon for proliferation times upwards of 12 days.

There is an easier, more efficient way. Enzymatic DNA extractions, driven by temperature changes in a single tube, effectively lyse nucleic acids from a very small number of cells, even single cells, without the need for harsh chemicals, multiple washes, or further purification. MicroGEM's *prepGEM* reagents solve the multi-step challenge, producing high-quality extracts in minutes, not hours. They are ideal for extracting DNA from blood, saliva, cell

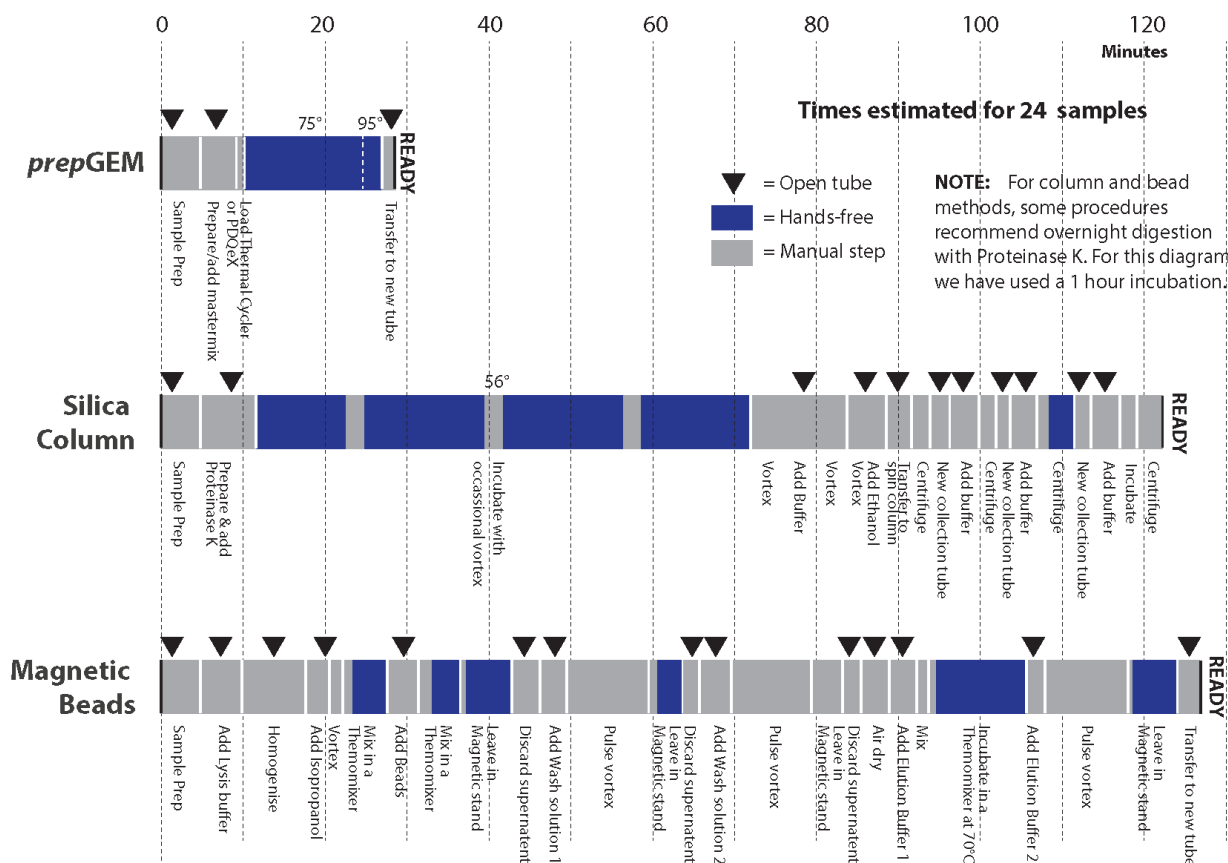
culture, tissue, and bacteria, and produce single-stranded DNA suitable for STR, PCR, qPCR, whole genome amplification, amplicon sequencing, and gene editing.

prepGEM offers a simple, rapid DNA extraction solution that leverages a thermostable proteinase and single-tube protocol. Activated at 75°C and inactivated at 95°C, this powerful, broad-specificity enzyme protects precious samples from nucleases and so ensures all DNA is preserved. The method is automatable, closed-tube, and does not require further purification for reliable downstream analysis. The reagents efficiently lyse the cells, hydrolyse nucleases, and clear protein from strands of nucleic acids, preparing them for analysis. Greater sensitivity is achieved, especially with low abundance transcripts and small sample volumes as nucleic acids are preserved in the process.

The *prepGEM* Advantage?

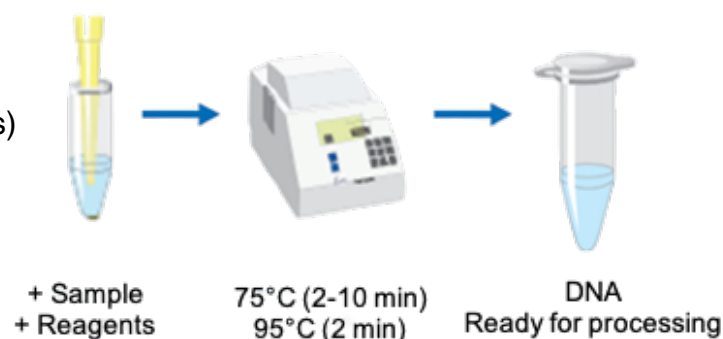
- Stream-lined approach extracts DNA in under 15 minutes
- Inhibitor-free reagents mean no harsh chemical washes or multiple steps
- Single-tube extractions protect the integrity of the sample
- Simplified workflow frees up preparation time, reduces lab costs, and significantly reduces environmental impact from hazardous and plastic waste.

The workflow is significantly faster than conventional column and bead methods and is much simpler:



A Standard MicroGEM DNA Extraction Protocol

- Prepare sample
- Mix sample and reagents (*prepGEM* and buffers)
- Place in a standard thermocycler for 2-10 minutes at 75°C
- Denature *prepGEM* for 2 minutes at 95°C



The MicroGEM method has an exceptionally high DNA recovery with no loss of DNA during the extraction process. Researchers can work with fewer cells and still get enough DNA for downstream analysis. The time to grow cells is significantly reduced. Results are much faster.

The approach is easily scaled to high-throughput levels by simply using a 96-well plate and PCR machine. This allows researchers to genotype 96 cell lines simultaneously. With protocols as short as 4 minutes start to finish, a laborious process now becomes quick and very efficient.

Select Examples of DNA Extraction Using MicroGEM* for CRISPR Protocols

The Wang group (2020) used the CRISPR-Cas spacer acquisition process to study horizontal gene transfer (HGT) between bacteria, in this case an E.coli recording strain and a microbial sample. Spacers were acquired from transferred plasmids and stored in genomic CRISPR arrays. DNA was extracted using *prepGEM* Bacteria as part of the group's established sequencing pipeline. The study found that HGT into the recording strain in human clinical fecal samples was driven by different plasmid types.¹

Using a generalized platform for screening and selection of functional bacterial CRISPR-Cas transcription activators, the Wang group (2020) identified a novel CRISPR activator, dCas9-AsiA, to activate gene expression by up to 200-fold across genomic and plasmid targets, expanding capabilities to perform gene regulation in bacteria. To quantify abundance, plasmid DNA from each sample was extracted using *prepGEM* Bacteria to generate a DNA amplicon sequencing library.²

Zhang Y et al (2016) successfully used CRISPR-Cas9 mediated integration of a site-specific homozygous mutation in CHMP2B to generate a human-induced pluripotent stem cell line for the study of familial frontotemporal dementia. *prepGEM* was used for DNA extraction for downstream amplification.³

The Church group (2014) described a protocol for Cas9-mediated human genome engineering to deliver Cas9 and guide RNA (gRNA) into human-induced pluripotent stem cells (hiPSCs) and HEK293 cells. It also described methods to assess genome editing efficiency using next-generation sequencing and isolate monoclonal hiPSCs with the desired modifications for downstream applications. *prepGEM* was used in basic protocol 3, *Genotyping Transfected Cells using Next-Generation Sequencing*, to harvest cells to create the sequencing library.⁴

In a study investigating single nucleotide variations impacting the specificity of Cas9, the Church group (2014) combined whole genome sequencing and deep-targeted sequencing to characterize the off-target effects of Cas9 editing. Extracted genomic DNA using *prepGEM* was used for site-specific deep sequencing to predict off-target sites in a population of Cas9-treated cells.⁵

*MicroGEM reagents were previously marketed under the name 'ZyGEM'.

Conclusion

The CRISPR process can often be laborious and, with the inherent loss of DNA from conventional DNA extraction methods, require long proliferation times to ensure adequate quantities of cells and adequate quantities of DNA. The MicroGEM rapid protocol allows researchers to shorten proliferation time, limit extraction time, and process a large number of samples simultaneously to streamline the CRISPR genotyping workflow to a few simple, efficient steps.

References

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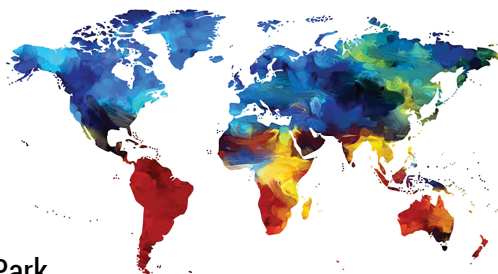
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Find out more about *prepGEM* at

<https://microgembio.com/product/prepgem-universal-dna-extraction/>

At MicroGEM, our goal is to democratize molecular biology, enabling a broader spectrum of users to both employ and benefit from molecular techniques. The first step is the simplification of sample preparation. Our temperature-driven, single-tube process simplifies and reduces the number of steps for conventional nucleic acid extraction, resulting in high-quality extracts with reduced contamination and high yields - all in minutes, not hours.

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