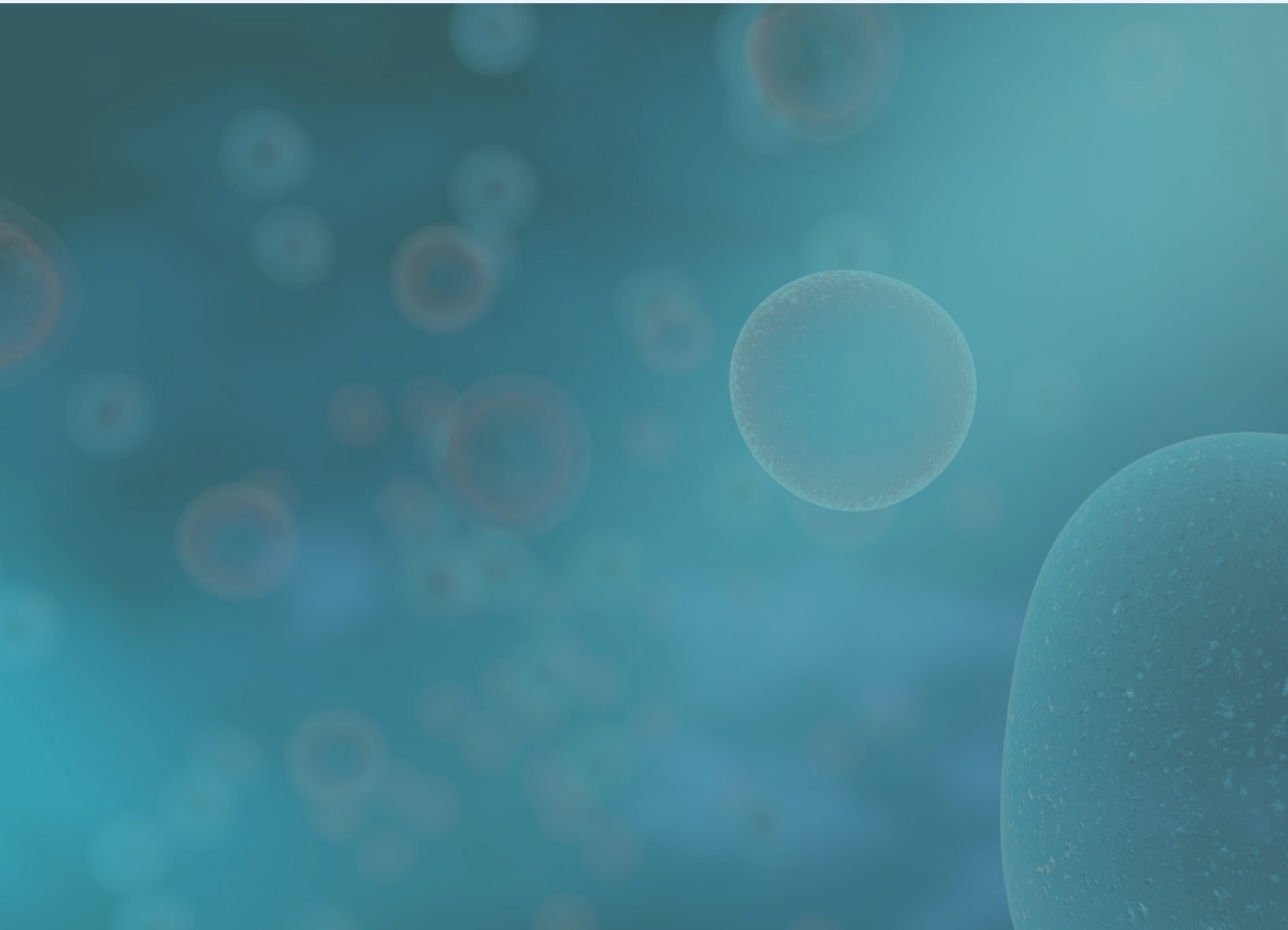
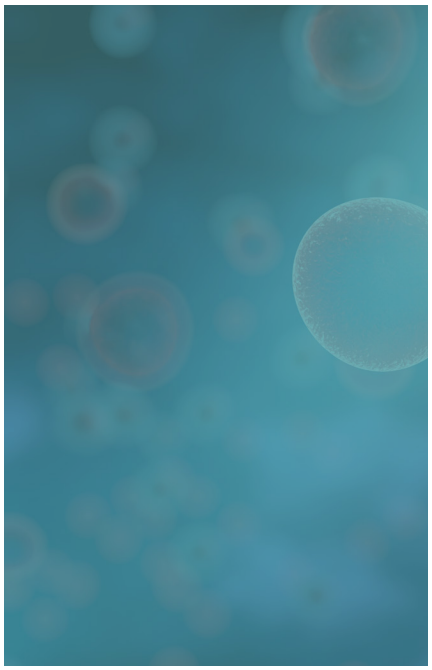
WHITE PAPER

LEVITAS BIO®

A New Era of 'Omics with High-Throughput Cell Enrichment & Washing



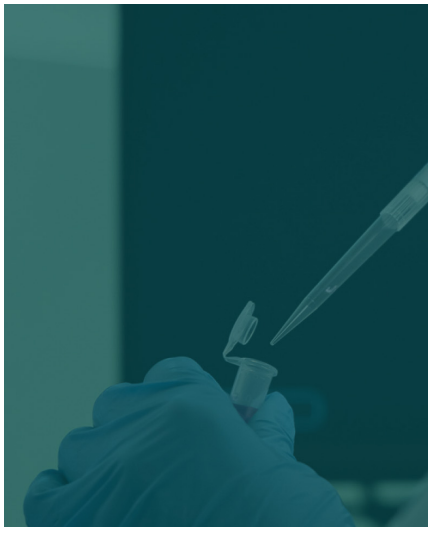
Introduction



Cell enrichment and debris removal from samples are an important step for delivering high quality inputs going into analytical techniques such as next-generation single-cell sequencing and flow cytometry. Given the heterogeneous population of cell states (viable, dead / dying, and debris) found in typical cell culture and dissociated tissue-derived samples, without enrichment, the resulting data may not be representative of the underlying sample biology. While approaches are currently available to address this, they often require serial, manual stepwise workflows, impacting the ability to scale up sample throughput. For today's 'omics approaches that rely on big data to generate biological insights, the bottleneck is clear — sample processing at scale.

Levitation-based cell enrichment and washing offers a compelling alternative to legacy methods that struggle to meet modern research demands. The ability to scale from a single sample to 96 samples in parallel addresses the sample processing bottleneck, and enables better insights from big data like never before. This primer compares traditional cell enrichment and washing approaches to Levitation Technology™, providing a glimpse of the possibilities of 'omics with the right tools.

Feature	Centrifugation	Bead-based Methods	FACS	Levitation Technology
Label-Free	✔	✘ (requires antibodies)	✘ (requires fluorophores)	✔
Viability Preservation	Moderate	Moderate	Low–Moderate (can be harsh)	High
Workflow Complexity	Low	Medium	High	Low
Time to Results	Fast	Moderate	Slow (sorting throughput limits)	Fast
Scalability	Limited	Moderate	Low–Moderate	High (96-well HT format)
Enrichment Specificity	Low	High	Very High	High (based on density/viability)
Equipment Investment	Low	Medium	High	Medium (compact benchtop system)



Use Case Highlights: Improving Sample Quality for Downstream Applications

Researchers preparing samples for single-cell sequencing, organoid development, or functional assays benefit from higher viability and purity. Levitation Technology has demonstrated:

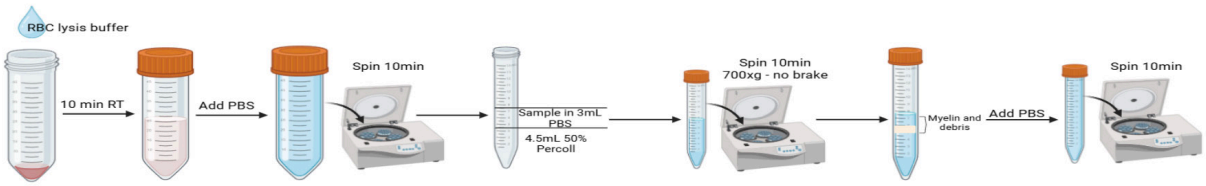
- Improved read depth and transcriptomic quality in single-cell RNA-Seq
- Enhanced engraftment and model consistency in xenograft studies
- Reduced sample variability across replicates

The following use case examples illustrate how integrating Levitation Technology can significantly enhance sample quality and optimize outcomes for downstream applications.

Use Case #1

Parallel High-Throughput Neural Cell Isolation + Myelin Depletion

TRADITIONAL



HIGH-THROUGHPUT LEVITATION TECHNOLOGY

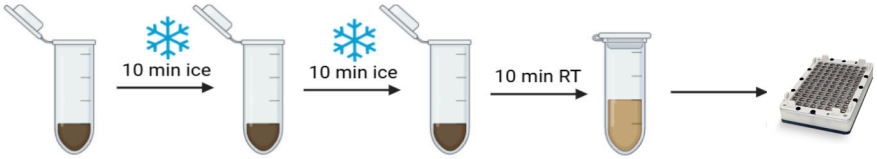


Fig 1.

We describe a workflow using a high-throughput approach for neural cell enrichment, typically obtained from dissociated brain tissue while simultaneously removing contaminating myelin aggregates. Presence of excess myelin impacts cell yields, interfering with flow cytometry and single-cell microfluidics, and downstream scRNA-Seq analysis which negatively impacts data quality and consistency.

The traditional approach is Percoll-based density gradient centrifugation, which effectively removes myelin but is highly labor and time-intensive, not amenable to high-throughput processing. On the other hand, high-throughput Levitation Technology streamlines this process with fewer manual steps, and semi-automated cell isolation and myelin depletion that is scalable up to 96 samples at a time.

10-fold time and step savings

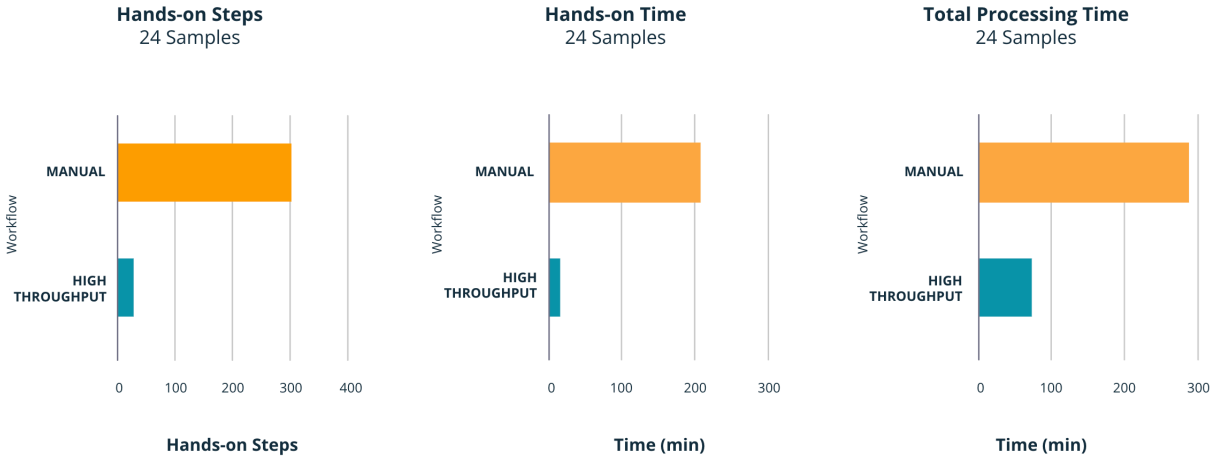


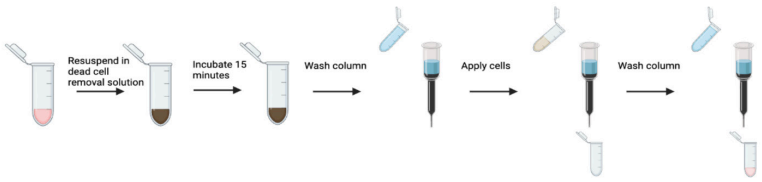
Fig 2.

High-throughput Levitation Technology enables exponential improvements in hands-on time and steps involved in the workflow, enabling you to do much more. A parallelized operation for cell enrichment and myelin depletion, shown here for processing 24 samples at a time, ensures consistency for each sample and high quality data for downstream analysis.

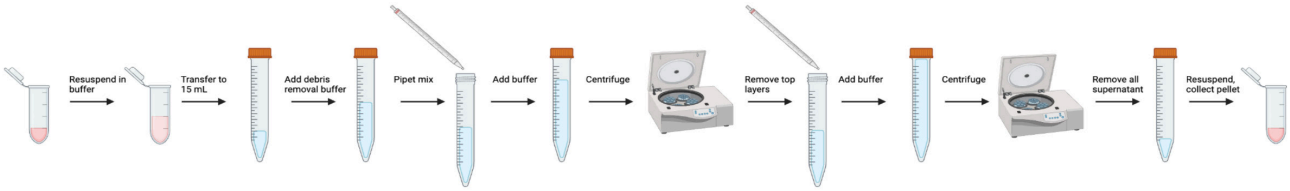
Use Case #2

Parallel High-Throughput Tumor Cell Isolation from Dissociated Tissue + Debris Removal + CD45 Depletion

LIVE CELL ENRICHMENT USING MAGNETIC BEADS



DEBRIS REMOVAL USING DENSITY GRADIENT



CD45+ DEPLETION USING MAGNETIC BEADS

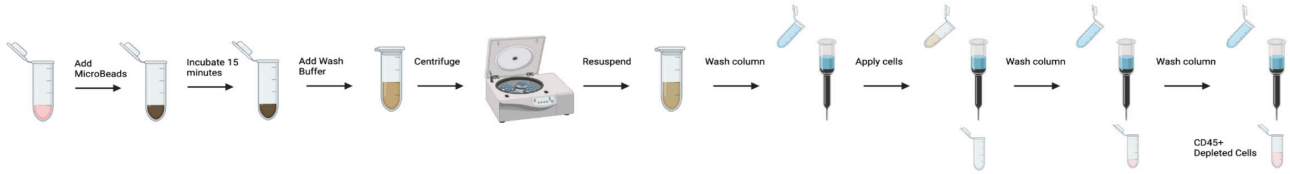
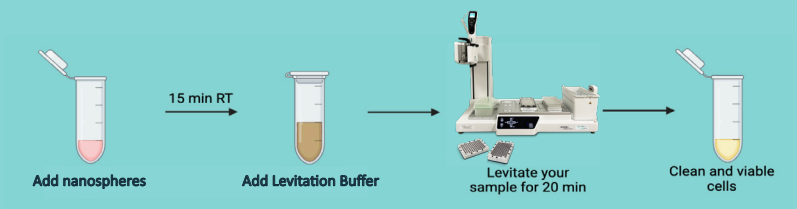


Fig 3.

We describe a workflow using a high-throughput approach for tumor cell enrichment from dissociated tissue, combined with debris removal and depletion of CD45-positive cells to enable tumor-enriched analysis. Existing workflows require serial approaches for cell enrichment, followed by debris removal, and lastly depletion of unwanted cells resulting in processing inefficiencies and per sample costs. A high-throughput approach circumvents these constraints by stacking all three of these approaches in one assay, delivering unparalleled level of processing power and ability to tackle large cohort sample projects

ALL THREE PROCESSES - DONE SIMULTANEOUSLY

Live Cell Enrichment, Debris Removal, Depletion of Unwanted Cells



LEVITAS BIO®

EXPONENTIAL TIME & STEP SAVINGS

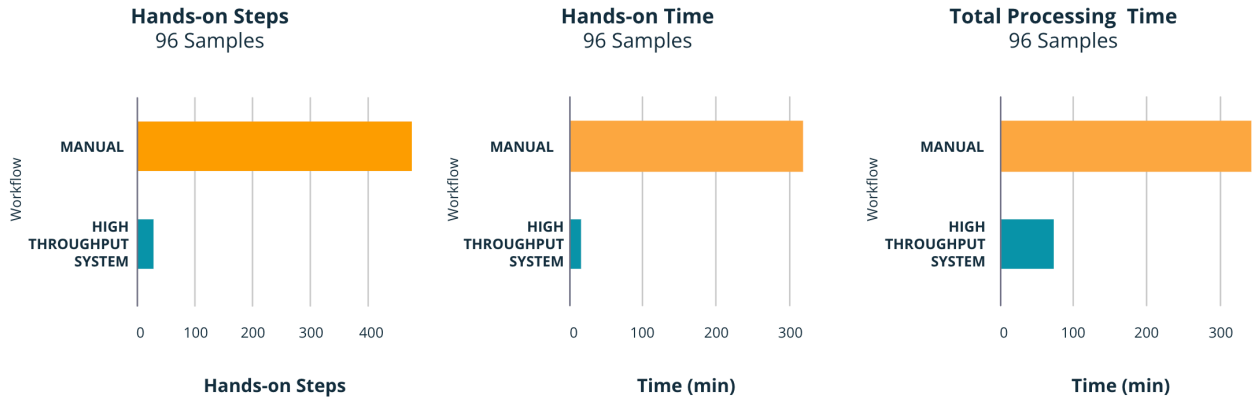


Fig 4.

High-throughput Levitation Technology enables exponential improvements in hands-on time and steps involved in the workflow, enabling you to do much more. Similar to the first use case, both hands on steps and times are significantly reduced compared to serial methods.

Levitation Technology Delivers More from Single-Cell Experiments

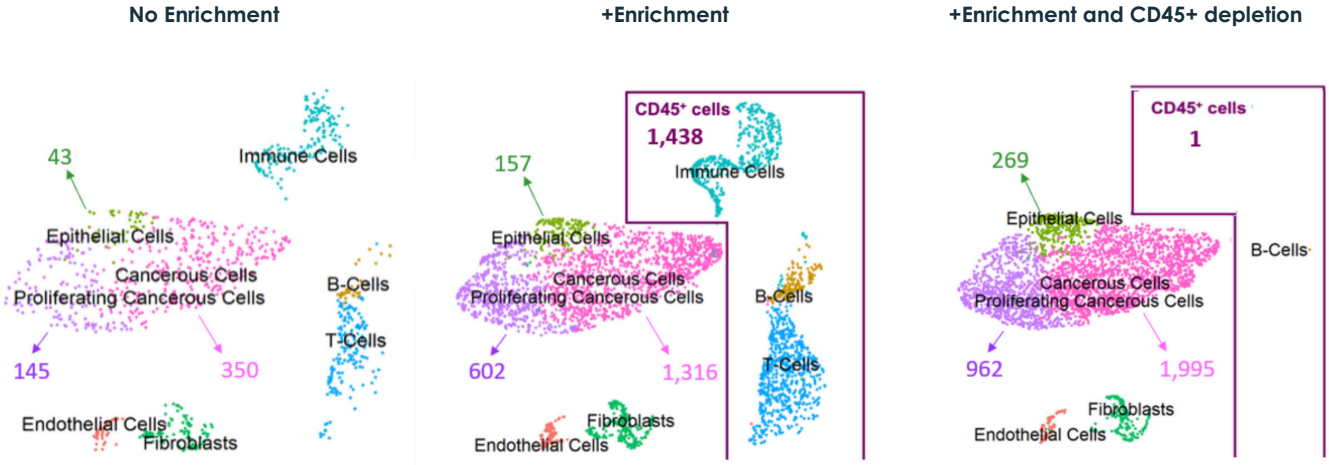


Fig 5.

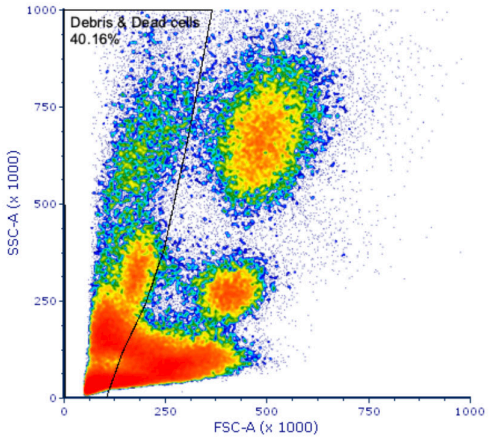
Single-cell RNA-Seq results demonstrate tumor cell enrichment and depletion of unwanted CD45 positive cells vs non-enriched starting sample. Use of enrichment followed by depletion provides a clear picture of cell type representation, mitigating sample variation and more confidence in biological insights generated from samples.

Viable Cell Enrichment + CD45+ Depletion = 6X More Representative Tumor Cells

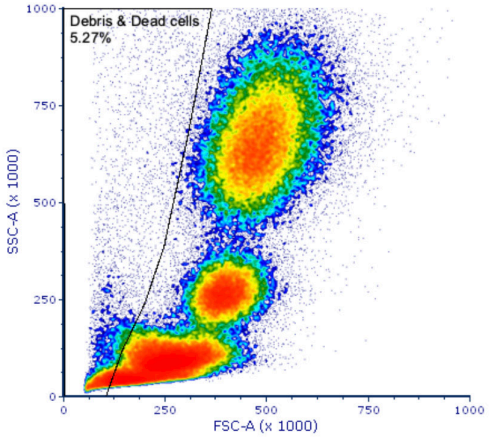
Use Case #3

Scale Up Cell Washing with High-throughput Levitation Technology

After manual wash



After levitation wash



Cell Washing + Live Cell Enrichment in one go.
No additional steps required

Fig 6.

We demonstrate here that debris is efficiently removed from cryopreserved PBMC sample using Levitation Technology, and maintains representative cell populations. Up to 24 samples at a time can be processed with high-throughput Levitation Technology, delivering workflow efficiencies across all assays (e.g. post-cell staining for FACS, CITE-Seq) requiring samples to be washed prior to downstream assays.

Conclusion

While centrifugation, bead-based methods, and FACS have long been the standard for cell separation and enrichment, each comes with trade-offs in terms of complexity, throughput, and cell quality. Levitation Technology offers a next-generation, label-free alternative that aligns with modern research demands—prioritizing viability, simplicity, and scalability. As life sciences evolve, so must sample preparation methods. LevitasBio's Levitation Technology represents that evolution in action.

About LevitasBio

LevitasBio is redefining cell separation with the first truly label-free, gentle technology powered by levitation. Our mission is to eliminate sample prep bottlenecks and unlock the full potential of every cell for impactful research and discovery.

Better Enrichment. Superior Data.

Interested in learning more about high-throughput Levitation Technology?

Visit **levitasbio.com**

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