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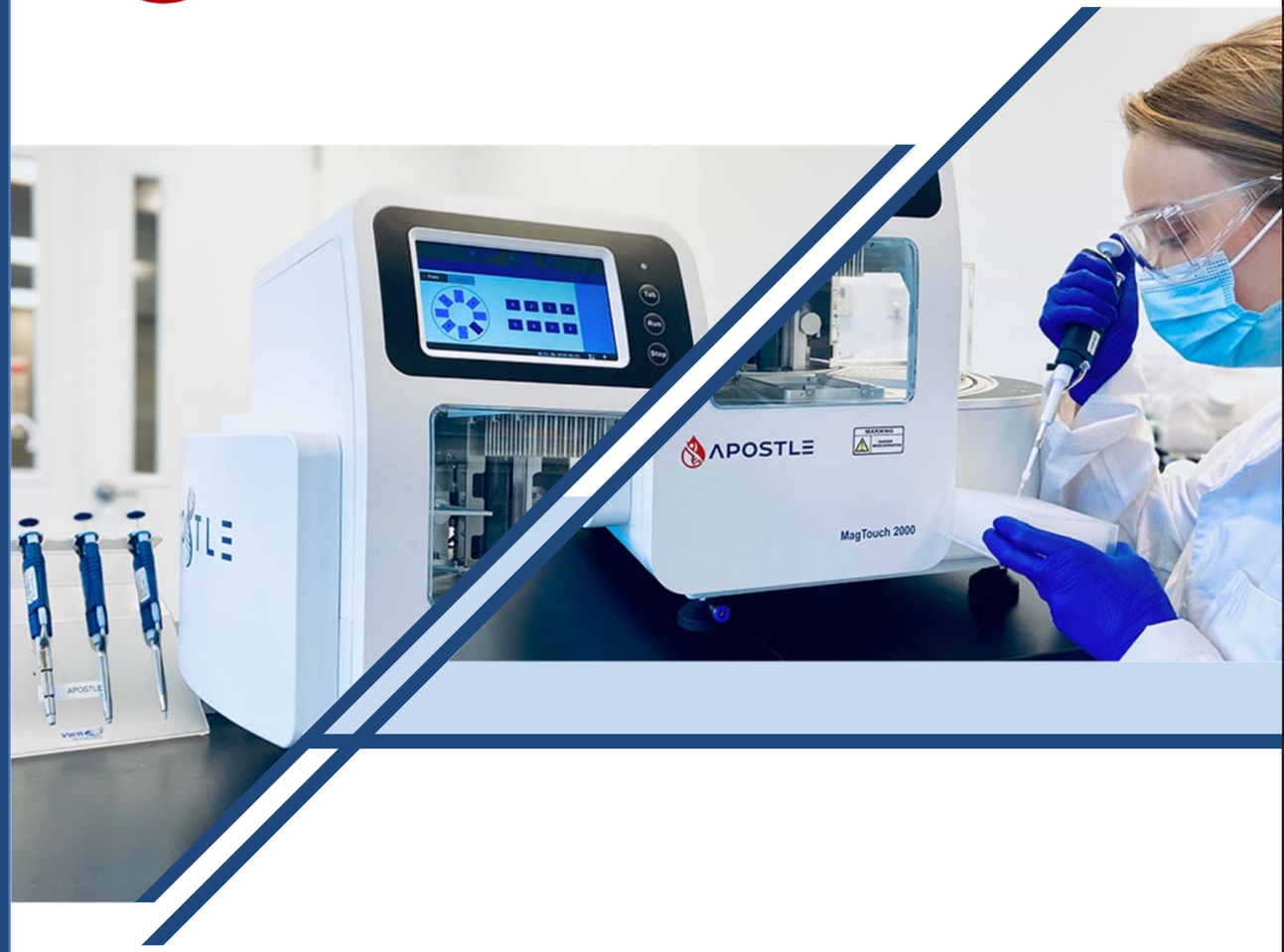
Apostle Inc

APOSTLE



Best-in-Class

Nucleic Acid Isolation and Preservation Technologies

Contents

Introduction

Who We Are

Apostle Inc. is a biotechnology company headquartered in Pleasanton, CA, a provider of innovative technologies and services for public health and life sciences.

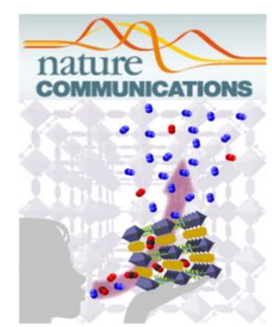
Pleasanton, CA

Technologies and Products

Apostle aims to develop best-in-class nucleic acid isolation and preservation technologies. Specifically, we aim to develop innovative technologies in the field of cell-free DNA (cfDNA), used in noninvasive prenatal testing (NIPT) and liquid biopsy - the sampling and analysis of non-solid biological tissue, primarily blood, often utilizing cfDNA as a biomarker. Our innovations include Apostle MiniMax, a best-in-class and automatable solution to efficiently capture cfDNA from a standard blood draw; Apostle MagTouch, a nucleic acids isolation automation system; and Apostle MiniEnrich, a high-resolution DNA size enrichment technology using a magnetic nano-platform.

In addition, Apostle also provides the MiniGenomics product series, providing efficient, scalable, and reproducible isolation of high-quality genomic DNA and/or RNA from a variety of biological specimens. The Apostle MiniGenomics product series has significantly contributed to the fight against COVID-19 during the recent pandemic.

Apostle technologies have been widely applied in many world-class R&D studies, clinical laboratory settings, and public health response and surveillance. These applications have resulted in many high-profile scientific publication, including ***Nature Medicine***, ***Nature Communications***, ***Science Translational Medicine***, ***PNAS***, etc. To date, the company's products have served over 20 million people, while we are continuing to improve our technologies and products to further our mission to benefit public health and life sciences.



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Technology and Product List

Cell-Free Nucleic Acids Isolation Kit	
Item	Cat#
Apostle MiniMax High Efficiency Cell-Free DNA Isolation Kit (Standard Edition)	A17622-10 A17622-50 A17622-250 A17622-600 A17622-1536
Apostle MiniMax High Efficiency Cell-Free DNA Isolation Kit (Type S)	A17830-10 A17830-50
Apostle MiniMax High Efficiency Cell-Free RNA Isolation Kit	A18312-10 A18312-50
Apostle MiniMax High Efficiency cfDNA/RNA (cfNAs) Isolation Kit	A18725-50
Apostle MiniMax High Efficiency Cell-Free DNA Isolation kits components	A17622-MN-1536 A17622-PK-1536 A17622-LB-1536 A17622-BS-1536 A17622-WS-1536 A17622-W2-1536 A17622-EB-1536

Genomic DNA Isolation	
Item	Cat#
Apostle MiniGenomics Viral Total NA Isolation Kit	A200619-384 A200619-1536 A200619-6144
Apostle MiniGenomics Blood Fast Kit	A180903-50 A180903-200
Apostle MiniGenomics Tissue Fast Kit	A180904-50 A180904-200
Apostle MiniGenomics FFPE Fast Kit	A180905-50 A180905-200
Apostle MiniGenomics Stool Fast Kit	A181206-50 A181206-200

Genomic DNA Isolation	
Item	Cat#
Apostle MiniGenomics Saliva Fast Kit	A180910-50 A180910-200
Apostle MiniGenomics Genital Tract Swab Fast Kit	A181220-50 A181220-200
Apostle MiniGenomics	A181229-50 A181229-200
Apostle MiniGenomics Stool Fast Kit (Microbe)	A181230-50 A181230-200

Nucleic Acids Extraction Automation System	
Item	Cat#
Apostle MagTouch 2000 Nucleic Acids Extraction Automation System	A201126-24 A201126-96
Apostle MagTouch 24 Deep-well Plate	A190411
Apostle MagTouch 24 tip comb +Deep-well Plate Set	A901213
Apostle MagTouch 96 Tip comb	A901212
Apostle MagTouch 96 Deep-well Plate	A901214

Sample Collection and Preservation	
Item	Cat#
Apostle MiniMax cfDNA Blood Collection Tube	A17930-5 A17930-100 A221012-100
Apostle MiniMax cfDNA Preservative	A17911-3
Apostle MiniGenomics Fecal Preservation Solution	A19708-10 A19708-25
Apostle MiniGenomics Fecal Preservation Solution kit	A19710-20 A19710-25
Apostle MiniGenomics Saliva Preservation Solution	A19709-25

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Short Fragments Enrichment Kit	
Item	Cat#
Apostle MiniEnrich Short Fragments Enrichment Kit	A190925-20 A190925-50

Next-Gen Size Selection and Purification	
Item	Cat#
Apostle MiniEnrich Carboxyl Beads for Size Selection	A190606-30
Apostle MiniEnrich Carboxyl Beads for Purification	A190607-30

Viral Total NA Isolation Kit with Consumables	
Item	Cat#
Apostle MiniGenomics Viral Total NA Isolation Kit, with Plates & Tip Combs Included	A200619P-384 A200619P-1536 A200619P-6144

Urinary Tract Microbiota DNA Isolation	
Item	Cat#
Apostle MiniGenomics High Efficiency Urinary Tract Microbiota DNA Isolation Kit	A210701-50

Apostle MiniMax Magnetic Nanoparticles	
Item	Cat#
Apostle MiniMax High Efficiency Magnetic Nanoparticles	A320-5
Apostle MiniMax High Efficiency Magnetic Nanoparticles	A320-20

Pipette Tips	
Item	Cat#
Apostle AFT10 Aerosol Filtered Pipette Tip, Extended	ACLT10C09
Apostle AFT200 Aerosol Filtered Pipette Tip, Extended	A801109
Apostle AFT1000 Aerosol Filtered Pipette Tip, Extended	ACLT1000C09

Clinical Molecular Diagnostics	
Item	Cat#
Apostle SMA-T *SMN1* Exon deletion detection kit for human motor neuron survival gene 1 (*SMN1*) (fluorescence quantitative PCR)	A190918-025 A190918-050 A190918-100
Apostle SMA-T *SMN2* Copy number detection kit for human motor neuron survival gene 2 (*SMN2*) (fluorescence quantitative PCR)	A190919-025 A190919-050 A190919-100

Bioinformatics Analytics Platform	
Item	Cat#
Apostle Triton cfDNA-AI Analytics Platform	A171030
Apostle Triton NIPT-AI Analytics platform	A190828

Cell-Free Nucleic Acids Isolation

Apostle MiniMax® High Efficiency Cell-Free DNA Isolation Kit (Standard Edition)

BEST IN CLASS

Description： Powered by Apostle MiniMax® technology, Apostle MiniMax® High Efficiency cfDNA Isolation Kit offers the best-in-class performance and is an excellent tool for the isolation of ultra-low concentration cell free DNA (cfDNA). It can achieve over 95% DNA recovery in range between 80-3000 bp, and suitable for NGS and PCR based downstream applications.

Catalog #： A17622-10, A17622-50, A17622-50, A17622-250, A17622-1536, A17622-600

Sample types： Plasma, Serum, Urine, Cerebral spinal fluid, Saliva, Pleural effusion

Sample volume： 0.2 mL-10 mL

Features：

- Best-in-class performance, independently validated (see *Publication & Reference*)
- Highly efficient and reproducible recovery
- Removal of PCR inhibitors
- Scalable format for flexible input and elution volume
- Compatibility with various cfDNA blood collection tubes
- High throughput compatibility with automation systems
- Eco-friendly: non-polystyrene nanoparticle; protect our ocean and planet

Apostle MiniMax® High Efficiency Cell-Free DNA Isolation Kit (Type S)

Description： Powered by Apostle MiniMax technology, Apostle MiniMax High Efficiency cfDNA Isolation Kit (Type S) is an excellent tool for the isolation of ultra-low concentration cell free DNA (cfDNA). Apostle MiniMax High Efficiency cfDNA Isolation Kit (Type S) is featured for its efficient recovery of small DNA fragments (<100 bp) from biological samples, where major alternative products fail. This feature is useful when small DNA molecules have significant presence in the biological sample and need to be isolated.

Catalog #： A17830-10, A17830-50

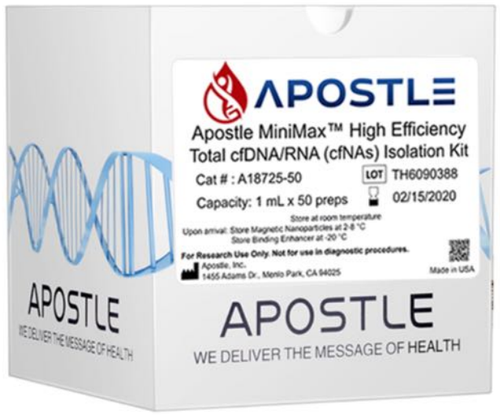
Sample types： Plasma, Serum, Urine

Sample volume： 0.2 mL-10 mL

Features：

- Over 95% isolation efficiency for single-stranded DNA
- Superior small DNA isolation efficiency for double-stranded DNA (<80 bp)

Apostle MiniMax® High Efficiency cfDNA/RNA(cfNAs) Isolation Kit



Description: Apostle MiniMax® cfDNA/RNA(cfNAs) isolation kit is featured for its efficient recovery of cfDNA in the range between 50-3000 bp and cfRNA in the range between 17-1000 nt. The isolated nucleic acids can then be applied for NGS and PCR-based downstream applications.

Catalog #： A18725-50

Sample types： Plasma, Serum

Sample volume： 0.2 mL-10 mL

Features：

- Superior isolation efficiency without using phenol or chloroform
- Recovery of cfDNA /cfRNA in one sample

Apostle MiniMax® High Efficiency Cell-Free RNA Isolation Kit

Description: Apostle MiniMax High Efficiency cfRNA Isolation Kit offers superior isolation efficiency of cell-free RNAs between 17 nt to 1000 nt, without phenol or chloroform. Ready for a broad range of subsequent applications, including sequencing, PCR, etc. It is also suitable for processing samples collected in various major blood collection tubes, especially, which will prevent RNA degradation during storage.

Catalog #： A18312-10, A18312-50

Sample types： Plasma, Serum

Sample volume： 0.2 mL-1 mL

Features：

- Supports plasma and serum form the EDTA tube and other cfRNA tubes
- Superior cfRNA isolation efficiency without using phenol or chloroform

Apostle MiniMax High Efficiency Cell-Free DNA Isolation Technology
PUBLICATIONS AND APPLICATIONS

Apostle MiniMax technology offers best-in-class efficiency and purity compared with conventional technologies to capture and isolate the circulating cell-free genetic materials. It is trusted by many of the world's most prestigious leaders in life sciences.

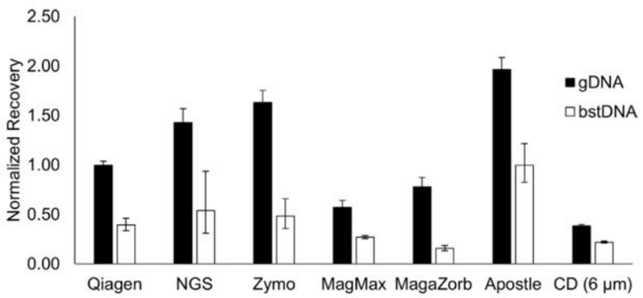


Figure 4. Comparison of DNA yields using silica-magnetic particles from different manufacturer. Extracted DNA yields when using different silica-coated magnetic particles with Qiagen extraction reagents (gDNA) and bisulfite conversion with the Zymo Lightning Conversion kit (bstDNA).

Figure 4. "Most notably, the Apostle particles outperformed all others, achieving almost 2-fold higher recovery yields than the particles supplied in the X kit. " High-throughput sample processing for methylation analysis in an automated, enclosed environment. SLAS Technology Volume 27, Issue 3, June 2022, Pages 172-179. (Johns Hopkins University)

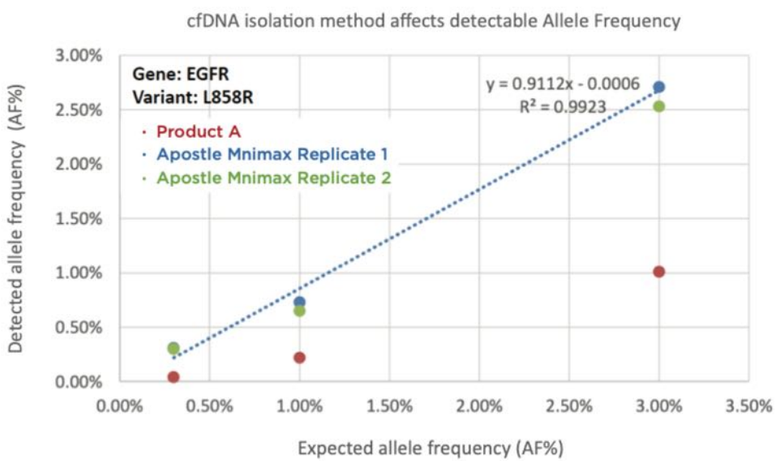


Figure 1. "cfDNA isolated by Apostle MiniMax cfDNA isolation kit shows higher concordance between detected AF% and expected AF%". cfDNA Extraction Efficiency Affects NGS Data. Technical Notes (Beckman Coulter Life Sciences)

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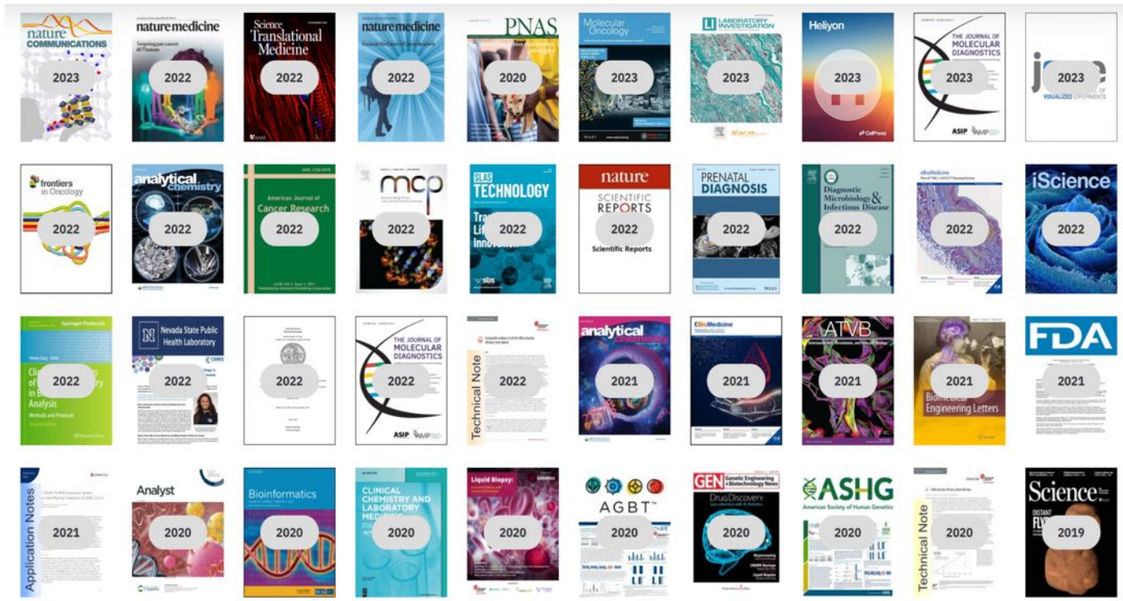
Integrative modeling of tumor genomes and epigenomes for enhanced cancer diagnosis by cell-free DNA.

"Our integrative model detects early-stage cancers, including those of pancreatic origin, with high sensitivity that is comparable to that of late-stage detection"…"(Methods section) cfDNA was extracted from 0.4 mL plasma ... and eluted in a final volume of 22 µL, using an Apostle MiniMax High Efficiency cfDNA Isolation Kit (Apostle, US) according to the manufacturer's instructions."

- An independent clinical study published in Nature Communications by a joint clinical team.



Apostle MiniMax cf-DNA technologies have been applied in many world-class R&D studies, clinical laboratory settings, and public health response and surveillance. Apostle MiniMax cf-DNA technologies can be applied in:

- Oncology
- Virology and Public Health
- NIPT (Noninvasive Prenatal Testing)
- Cardiovascular Research
- NGS (Next-Gen Sequencing)
- rtPCR (Real Time PCR)
- ddPCR (Droplet Digital PCR)
- DNA Methylation Analysis
- Clinical Trial

Apostle MiniMax High Efficiency Cell-Free DNA Isolation Technology Comparison with other products

Product	Apostle MiniMax® cfDNA Isolation Kit	Competing Product Q (Circulating Nucleic Acid Kit)	Competing Product Q (ccfDNA/RNA Kit)	Competing Product T (Cell-Free DNA Isolation Kit)	Competing Product T (Cell-Free Total Nucleic Acid Isolation Kit)
Method	Magnetic beads-based	Column-based	Column-based	Magnetic beads-based	Magnetic beads-based
Yields	High	Medium-high	Medium	Medium	Medium
Blood collection tube compatibility	All BCT compatible	EDTA plasma recommended	EDTA plasma only	All BCT compatible	All BCT compatible
Carrier RNA	Not introduced	Introduce carrier RNA that interferes with downstream characterization and analysis	Not introduced	Not introduced	Not introduced
Flexibility of input sample volume	High, reagents scalable based on input	Low, costs at least one column per extraction and requires tube extension for large volume		High, reagents scalable based on input	
Beads suspension	> 1 hour	N/A (Column-based)	N/A (Column-based)	10 mins	10 mins
Procedure Duration	70 mins	80 mins	40 mins	70 mins	100 mins
Automation Compatibility	(MagTouch 2000)	✘	✘		
Additional instrument required	Magnetic Rack (Manual); MagTouch 2000 (Automatic)	Vacuum manifold and pump	>5000g Centrifuge	Magnetic Rack	Magnetic Rack

Apostle Cell-Free DNA Isolation Kits Components

Description: The following table includes the individual components of the Apostle MiniMax High Efficiency Cell-Free DNA Isolation Kit, which can be purchased separately for the convenience of our customers. Powered by Apostle MiniMax technology, Apostle MiniMax High Efficiency cfDNA Isolation Kit is an excellent tool for the isolation of ultra-low concentration cell free DNA (cfDNA).

Features:

- Best-in-class performance, independently validated (see *Publication & Reference*)
- Highly efficient and reproducible recovery
- Removal of PCR inhibitors
- Scalable format for flexible input and elution volume
- Compatibility with various cfDNA blood collection tubes
- High-throughput compatibility with automation systems

Product	Cat#	SPEC
Apostle MiniMax High Efficiency Magnetic Nanoparticles	A17622-MN-1536	25.8 mL/bottle
Apostle MiniMax High Efficiency Proteinase K	A17622-PK-1536	20 mL/bottle
Apostle MiniMax High Efficiency Sample Lysis Buffer	A17622-LB-1536	169 mL/bottle.
Apostle MiniMax High Efficiency Lysis/Binding Solution	A17622-BS-1536	705 mL/bottle
Apostle MiniMax High Efficiency Wash Solution	A17622-WS-1536	845 mL/bottle
Apostle MiniMax High Efficiency 2nd Wash Solution	A17622-W2-1536	200 mL/bottle
Apostle MiniMax High Efficiency Elution Buffer	A17622-EB-1536	51 mL/bottle

Genomic DNA Isolation

Description： Apostle MiniGenomics® Genomic DNA Isolation Kit is used for fast extraction and purification of human and non-human genomic DNA from various kinds of biological samples stored in multiple forms and reagents.

Product features：

- Novel and original magnetic nanoparticle technology for DNA adsorption and releasing
- Sample types: Blood, FFPE, Tissue, Stool, Saliva, Genital tract swab, Virus
- Standard purification methods for biological samples stored in multiple forms or reagents
- Special reagent for effectively enhancing the quality of DNA of challenging samples
- Optimized standardized protocol for multiple kinds of biological samples to one kit
- Compatible with multiple high-throughput automated nucleic acid extraction platforms
- Eco-friendly: non-polystyrene nanoparticle; protect our ocean and planet

Product	Cat#	SPEC
Apostle MiniGenomics® Viral Total NA Isolation Kit	A200619-384 A200619-1536 A200619-6144	200uL X 384 preps/kit 200 μL×1536 preps/kit 200 μL×6144 preps/kit
Apostle MiniGenomics® Blood fast kit	A180903-50 A180903-200	200 μL×50 preps/kit 200 μL×200 preps/kit
Apostle MiniGenomics® Tissue fast kit	A180904-50 A180904-200	200 μL×50 preps/kit 200 μL×200 preps/kit
Apostle MiniGenomics® FFPE fast kit	A180905-50 A180905-200	200 μL×50 preps/kit 200 μL×200 preps/kit
Apostle MiniGenomics® Stool fast kit	A181206-50 A181206-200	200 μL×50 preps/kit 200 μL×200 preps/kit
Apostle MiniGenomics® Saliva fast kit	A180910-50 A180910-200	200 μL×50 preps/kit 200 μL×200 preps/kit
Apostle MiniGenomics® Genital Tract Swab fast kit	A181220-50 A181220-200	200 μL×50 preps/kit 200 μL×200 preps/kit
Apostle MiniGenomics® Virus fast kit	A181229-50 A181229-200	200 μL×50 preps/kit 200 μL×200 preps/kit
Apostle MiniGenomics® Stool fast kit (microbe)	A181230-50 A181230-200	200 μL×50 preps/kit 200 μL×200 preps/kit

Nucleic Acid Extraction Automation System

Apostle MagTouch® 2000

Introduction：

The Apostle MagTouch® 2000 instrument is an automatic extraction and purification system for nucleic acids from various types of biological samples collected in multiple transport media. It can absorb, transfer, and release magnetic beads by a magnetic rod and magnetic rod sleeve to separate magnetic beads and samples.

Catalog #: A201126-24; A201126-96

Sample types: Plasma, Serum, Urine, Tissue, FFPE, Stool, Genitourinary, Virus, etc.

Highlighted Features：

- High quality: Equal or better results compared with other brands
- Lower cost: Guaranteed 30% - 50% less cost than other brands
- Faster: One button start; Run time is approximately 40 minutes per 96 samples/24 samples
- Safer: Integrated with a UV light for unit interior disinfection

Performances：

- Well-to-well reproducibility: CV≤ 6%
- Batch-to-batch reproducibility: CV ≤ 5%
- Recovery rate of magnetic beads: ≥ 95%
- Recovery rate relative to manual extraction: ≥95%

Sample Collection and Preservation

Apostle MiniMax cfDNA Blood Collection Tube
Catalog #： A17930-5, A17930-100, A221012-100
Collection Volume： 3 or 10mL

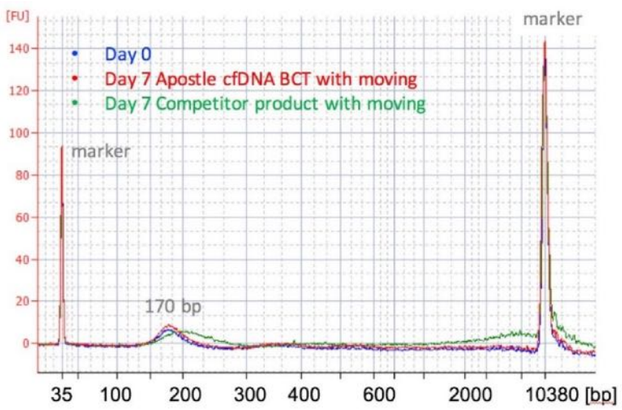
Apostle MiniMax cfDNA Preservative
Catalog #： A17911-3
Collection Volume： 3mL per tube. 20uL preservative per mL of whole blood

Description： Powered by Apostle MiniMax technology, Apostle MiniMax® cfDNA Blood Collection Tube (BCT) is an excellent tool for blood cfDNA preservation during blood collection, storage, and transport.

Sample type： Blood

Features：

- Prevent the release and contamination of genomic DNA from cells in blood during storage and transportation
- Preserve existing cfDNA in blood from degradation
- Prevent existing cfDNA in blood from cross-linking with other biomolecules (e.g. proteins)



Over 90% of cfDNA were recovered from samples collected in Apostle MiniMax® cfDNA BCT (red curve), as compared with the day 0 reference (blue curve). On the other hand, the blood collected in competitor's product resulted in a peak shift of isolated cfDNA from 170 bp to 200 bp (green curve). Minimal genomic DNA contamination was observed for blood stored in Apostle MiniMax® cfDNA BCT for 7 days.

Comparison between Apostle MiniMax® cfDNA blood collection tube (BCT) with competitor products

Properties \ Products	Apostle BCT	S BCT	Y BCT	K BCT	G BCT
Blood collection volume	10mL	10mL	10mL	10mL	10mL
cfDNA preservation efficiency	High	High	Medium	Medium	Medium
Major peak of cfDNA	Normal (~170 bp)	peak shift from 170 bp to 200 bp, indicating that the quality of cfDNA is affected			
Genomic DNA contamination	No	No	No	No	No
Price	Medium	High	Medium to low	Medium to low	Medium to low

3.3 Apostle MiniGenomics® Fecal Preservation Solution: used for the preservation of fecal samples (containing human intestinal cells).

3.4 Apostle MiniGenomics® Fecal Preservation Solution kit : used for the preservation of fecal samples (containing human intestinal cells).

3.5 Apostle MiniGenomics® Saliva Preservation Solution: used for the preservation of saliva samples.

Features:

- Ensure the yield of genomic DNA
- Inhibit excessive impurities in the products due to the breeding of microorganisms
- Store at room temperature for up to 7 days
- Ensure that the DNA quality in the sample is available for subsequent clinical in vitro testing
- Developing customized preservation solutions for various kinds of biological and cytopathological samples

Product	Cat#	Storage in room temperature	Validity
Fecal Preservation Solution	A19708-10 A19708-25	15-30^{0}C	12 months
Fecal Preservation Solution Kit	A19710-20 A19710-25	15-30^{0}C	12 months
Saliva Preservation Solution	A19709-25	15-30^{0}C	12 months

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Short Fragments Enrichment

Apostle MiniEnrich® Short Fragments Enrichment Kit

Description:

- Precise DNA sizing can boost sequencing efficiency, reduce cost, improve data quality, and even allow sequencing of low-input samples, while current pervasive DNA sizing approaches are incapable of differentiating DNA fragments under 200 bp with high resolution (<20 bp).
- Apostle MiniEnrich Short Fragments Enrichment Kit is a first-in-class, simple, automatable, high-resolution DNA size enrichment workflow on a magnetic nano-platform to exploit this 20 bp size difference and to enrich fetal DNA fragments from maternal blood.
- Provides a new tool for high-resolution DNA size enrichment under 200 bp, which may improve NIPT accuracy by rescuing rejected non-reportable clinical samples and enable NIPT earlier in pregnancy.
- First-in-class, published in: High-resolution DNA size enrichment using a magnetic nano-platform and application in non-invasive prenatal testing. Zhang, et al. ***Analyst***. July 2020, 145, 5733-5739

The fragment sizes of circulating free DNA show subtle variability from different origins, for example, Fetal vs. Maternal (Sci. Transl. Med. 2010: 2 (61), 61ra91), and Cancer vs. Normal (Nature 2019, 570, 385–389).

The current liquid biopsy technologies offer little resolution in differentiating and enriching for this small but important difference, resulting in sample rejections, test inaccuracies, and limited clinical utility of liquid biopsies. Apostle MiniEnrich® is a novel technology to address this challenge and efficiently capture this subtle variability, with data showing significant enrichment of target cfDNA fragments (Average Fetal Fraction/FF before enrichment = 12.96%; Average FF after enrichment = 19.92%; Average Delta FF = 6.97%, P = 0.001). This technology has the potential to rescue rejected or non-reportable clinical samples， improve test accuracy, and enable a much broader utility of liquid biopsies.

Catalog #: A190925-20, A190925-50

Sample types: cfDNA solution from Plasma, Serum, Urine, Cerebral spinal fluid, Saliva, Pleural effusion

Sample volume: 10uL – 100uL (cfDNA solution)

Features:

- For the fine tuning of cfDNA enrichment under 170 bp
- Applications in fetal fraction and cfDNA enrichment
- World's first and only product available for this purpose
- Patent pending: Method for enrichment and separation of short nucleic acids fragment fraction by magnetic bead-based chemistry, priority date 09/18/2019

Publication:

High-resolution DNA size enrichment using a magnetic nano-platform and application in non-invasive prenatal testing. Bo Zhang, Shuting Zhao, Hao Wan, Ying Liu, Fei Zhang, Xin Guo, Wenqi Zeng, Haiyan Zhang, Linghua Zeng, Jiale Qu, Ben-Qing Wu, Xinhong Wan, Charles R. Cantor and Dongliang Ge. ***Analyst***. July 2020, 145, 5733-5739

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Next-Gen Size Selection and Purification

Apostle MiniEnrich Carboxyl Beads for Size Selection

Description: The Apostle MiniEnrich Size Selection Beads are designed for size selection of DNA fragments from a mixture of DNA with various sizes, which potentially benefits downstream assays like NGS and other molecular biology workflows. It can be used on samples before or after DNA fragmentation, ligation, or library amplification during the NGS library preparation workflow. The kit is featured for customized cut-off size, efficient removal of non-target fragments, and recovery of target DNA fragments.

Catalog #： A190606-30

Sample types： nucleic acid solution

Sample volume： varies

Features:

- Novel magnetic nanoparticles structure and proprietary surface chemistry
- Compatible with current workflows
- Enhanced performance for specific removal of non-target fragments
- Significantly improved magnetic response for less pelleting time and less beads carry-over
- Eco-friendly: non-polystyrene nanoparticle; protect our ocean and planet

Performance Evaluation：

Apostle MiniEnrich Size Selection Beads is designed to precisely select DNA based on its size. It offers less DNA residue of non-target fragments, and selects DNA fragments in narrower size range, resulting sharp peak with good resolution and high yield for NGS workflows (Exhibit 1, 2, and 3).

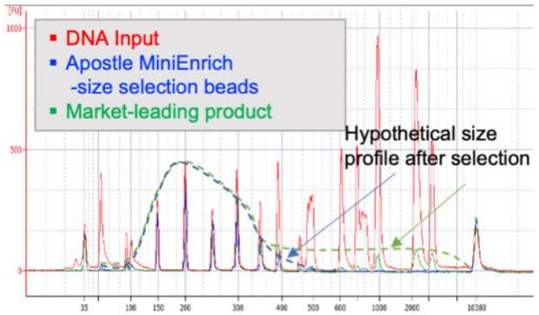

Exhibit 1. Less DNA residue results sharp peak with good resolution and high yield.
dsDNA step ladder (50-3000 bp) in a TE buffer (red) was treated with Apostle MiniEnrichTM Size Selection Beads for left-side size selection (blue) or a magnetic beads-based market-leading product (green). Compared to the market-leading product, Apostle MiniEnrich Size Selection Beads offers less DNA residue of non-target fragments (>500 bp), while preserves fragments of interest (<500 bp) with high yield. Less DNA residue of non-target fragments results in narrower size selection range, and sharp peak with good resolution and high yield.

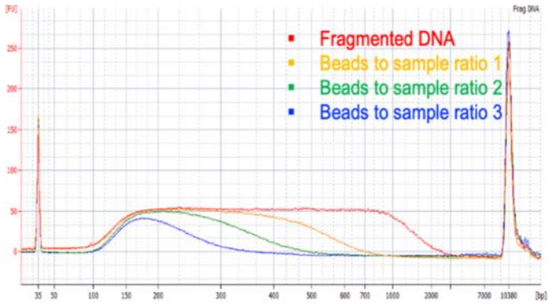

Exhibit 2. Adjust beads to sample ratio for customized size selection.
gDNA from Hela cells was fragmented by NEBNext® dsDNA Fragmentase® (red) and Apostle MiniEnrich Size Selection Beads was used to select DNA fragments of interest. By adjusting the beads to sample ratio, the cut-off can be achieved with good yield and resolution.

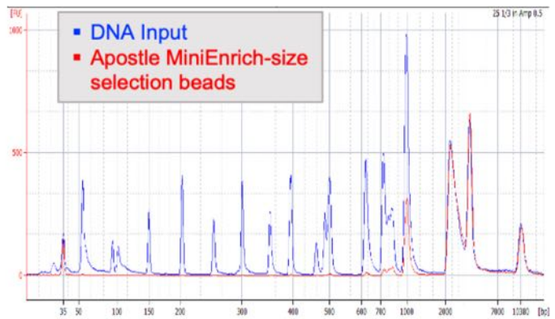

Exhibit 3. Size Selection for long fragments for long-read NGS and other applications.
dsDNA step ladder (50-3000 bp) in a TE buffer (blue) was treated with Apostle MiniEnrich Size Selection Beads for right-side size selection (red). Compared with DNA input (blue), Apostle MiniEnrich Size Selection Beads selects long DNA fragments (>1000 bp) from short fragments with good yield and resolution, which expands size selection to long-read sequencing, gaining more insights of samples.

Apostle MiniEnrich Carboxyl Beads for Purification

Description:

- The Apostle MiniEnrich Purification Beads is designed for purification and clean-up of DNA fragments from the contaminants in NGS and molecular biology workflows
- The kit is featured for its more efficient removal of contaminants and recovery of DNA fragments of interest than current market-leading products
- Can be used on samples after DNA isolation, fragmentation, PCR amplification, cloning, library preparation, etc.
- Eco-friendly: non-polystyrene nanoparticle; protect our ocean and planet

Catalog #: A190607-30

Sample types: nucleic acid solution

Sample volume: varies

Performance Evaluation:
Apostle MiniEnrich Purification Beads is designed to efficiently remove small fragments like primer, primer-dimer, adaptor, and adaptor-dimer, as well as other contaminates like dNTPs, salts, and enzymes, without compromising the yield of DNA fragments of interest. The more efficient removal of short fragments for PCR clean-up in library preparation work will improve sequencing efficiency and reduce cost (Exhibit 4, 5, and 6).

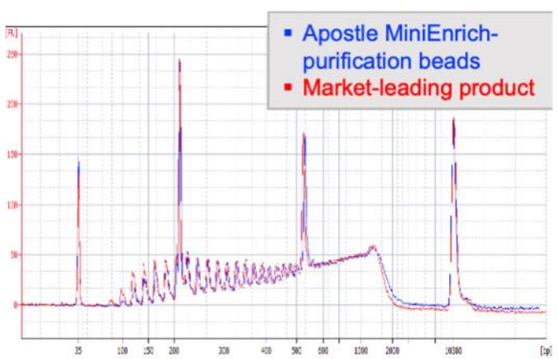

Exhibit 4. More efficient removal of fragments less than 150 bp for PCR purification.
dsDNA step ladder (20-1000 bp) in a TE buffer was treated with Apostle MiniEnrich Purification Beads (blue) or a magnetic beads-based market-leading product (red). Apostle MiniEnrich Purification Beads provides more efficient removal of short fragments (<150 bp), while preserving long fragments (>150 bp) with high yield. This data demonstrates that Apostle MiniEnrich Purification Beads can be used to remove excessive primers (20-30 bp), primer-dimers (40-60 bp), adaptors (50-60 bp), and adaptor-dimers (100-120bp), without compromising the yield of fragments of interest during molecular biology and NGS workflow.

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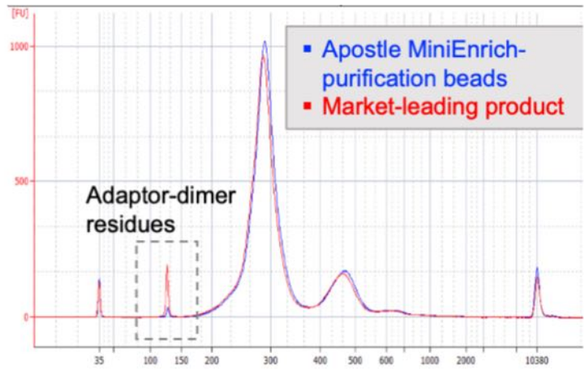


Exhibit 5. More efficient adaptor-dimer removal than competitors for cfDNA library preparation.
cfDNA isolated from plasma was processed with NEBNext® UltraTM II DNA Library Prep Kit for library preparation. The purification for the adaptor-ligation step and final PCR product was performed using Apostle MiniEnrich Purification Beads (blue) or a magnetic beads-based market-leading product (red). Compared to the market-leading product, Apostle MiniEnrich Purification Beads provides more efficient removal of excessive adaptor-dimers (120bp), while preserving the ligated cfDNA with high yield.

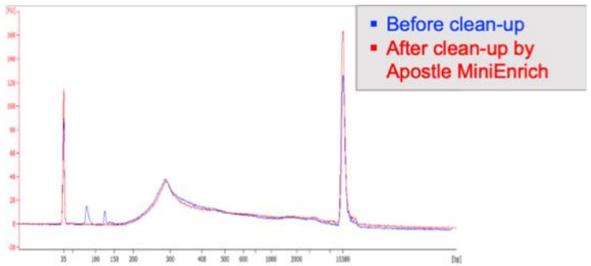


Exhibit 6. Efficient removal of adaptor and adaptor-dimers for gDNA library preparation.
Fragmented gDNA was processed with NEBNext® Ultra II DNA Library Prep Kit for library preparation. The purification for the adaptor-ligation step and final PCR product was performed using Apostle MiniEnrich Purification Beads (red). Compared with before clean-up (blue), Apostle MiniEnrich Purification Beads provides efficient removal of excessive adaptors (60 bp) and adaptor-dimers (120bp),while preserveing the ligated gDNA with high yield.

Viral Total NA Isolation Kit

Description:

The Apostle Nucleic Acid Extraction Automation System can be utilized with the Apostle High Efficiency Isolation Kit to automate the isolation process, and significantly improve the lab flow and efficiency.

- For fast extraction and purification of viral nucleic acids from various kinds of biological samples collected in multiple transport media
- Novel and original magnetic nanoparticle technology for nucleic acids isolation
- Various sample types: swabs, saliva, blood
- Optimized standardized protocol for viral total NA isolation in 30 min without heating
- Compatible with multiple high-throughput automated nucleic acid extraction platforms

Product	Cat#	SPEC
Apostle MiniGenomics Viral Total NA Isolation Kit (384 preps), with Plates & Tip Combs Included	A200619P-384	200 μL×384 preps+4 pcs of tip comb+20 pcs of plates
Apostle MiniGenomics Viral Total NA Isolation Kit (1536 preps), with Plates & Tip Combs Included	A200619P-1536	200 μL×1536 preps+16 pcs of tip comb+80 pcs of plates
Apostle MiniGenomics Viral Total NA Isolation Kit (6144 preps), with Plates & Tip Combs Included	A200619P-6144	200 μL×6144 preps+64 pcs of tip comb+320 pcs of plates

Urinary Tract Microbiota DNA Isolation

Apostle MiniGenomics® High Efficiency Urinary Tract Microbiota DNA Isolation Kit

Description: The Apostle MiniGenomics® High Efficiency Urinary Tract Microbiota DNA Isolation Kit is designed for isolation of microbial DNA from urine samples. The kit uses proprietary Apostle MiniGenomics® technology, offers highly efficient, reproducible recovery of high-quality bacterial DNA with high yield. The isolated DNA samples are suitable for a broad range of subsequent applications, including sequencing, PCR, etc.

For urine samples with broad range of bacteria concentration (from 10^6 to 10^1 cfu/mL), Apostle MiniGenomics® High Efficiency Urinary Tract Microbiota DNA Isolation Kit isolates microbial DNA with steady recovery and high efficiency, and no significant PCR inhibitors remain in the DNA product. And the centrifugal pretreatment could turn the urine sample with extreme low dilute bacteria concentration to being in detectable range(concentration by dozens of times).

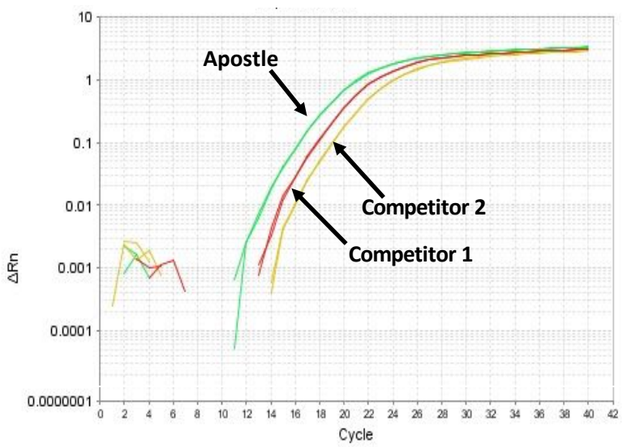
Catalog #: A210701-50

Sample types: Urine

Sample volume: 100-400uL

Extraction performance comparison to competitive products

A simulated-infection urine sample (fresh control urine spiked with E. coli, about 10^6 cfu/mL concentration) was separated into 9 aliquots, and bacteria DNA of the aliquots was extracted by Apostle MiniGenomics® High Efficiency Urinary Tract Microbiota DNA Isolation Kit and 2 competitor kits (3 aliquots for one kit). E.coli 16s rRNA gene of extracted DNA was detected by qPCR with the same volume (2 ul) of extracted DNA as the templates. Amplification curve (left) and CT values (right) are shown as below:



Amplification curve

PCR reactions of bacteria DNA from aliquot samples extracted by 3 kits, and all CT values presented

Kit	Apostle			Competitor 1			Competitor 2		
Sample	3 of 9 aliquots			3 of 9 aliquots			3 of 9 aliquots		
Target	16s rRNA gene			16s rRNA gene			16s rRNA gene		
CT Value	16.36	16.38	16.42	16.79	16.95	16.88	19.2	19.02	19.07
Mean CT	**16.39**			16.88			19.09		

The contrast test indicated that Apostle kit recovered more bacteria DNA from samples than competitive products on the market did.

Apostle MiniMax Magnetic Nanoparticles

Apostle MiniMax High Efficiency Magnetic Nanoparticles

Introduction：

Apostle MiniMax technology ensures precise capture and separation of DNA, RNA, and other biomolecules. This is achieved through Apostle's novel proprietary MiniMax magnetic nanoparticles with innovative features

Catalog #: A320-5; A320-20

Highlighted Features:

- Novel material composition and surface chemistry - completely distinct from the conventional paramagnetic or superparamagnetic technologies
- Exceptionally large surface area
- Minimized variation
- Best-in-class suspension property
- Superb magnetic power
- Superb resistance to particle clustering
- Eco-friendly: Non-polystyrene nanoparticle; protect our ocean and planet

Pipette Tips

Product	Apostle AFT10 Aerosol Filtered Pipette Tip, Extended	Apostle AFT200 Aerosol Filtered Pipette Tip, Extended	Apostle AFT1000 Aerosol Filtered Pipette Tip, Extended
Cat#	ACLT10C09	A801109	ACLT1000C09
Tips			
Pack			

Features:

- High quality universal pipette tips
- **Filtered, Sterile, Low retention**
- Non-Pyrogenic and free of RNase/DNase, DNA, ATP, and PCR inhibitors
- Extended length to prevent cross-contamination
- Racked: 96 tips/rack, 10 racks/pack, 5 packs/carton (4800 tips/carton)

Clinical Molecular Diagnostics

Apostle SMA-T® *SMN1*
Exon deletion detection kit for human motor neuron survival gene 1 (*SMN1*) (fluorescence quantitative PCR)

Catalog #: A190918
Size:
A190918-025: Apostle SMA-T® *SMN1*: 25 test/kit
A190918-050: Apostle SMA-T® *SMN1*: 50 test/kit
A190918-100: Apostle SMA-T® *SMN1*: 100 test/kit

Introduction: The Apostle SMA-T® *SMN1* kit is developed for qualitative detection of heterozygous or homozygous deletion of exon 7 of the human Survival Motor Neuron 1 gene (*SMN1*) in human genome. The Apostle SMA-T® *SMN1* Kit can be used for carrier screening and molecular diagnosis of Spinal Muscular Atrophy (SMA).

Scope of Application: This kit is designed for research use only. This kit is not intended to be used as a standalone assay for clinical diagnosis. The results of this test must be interpreted and signed off by a clinical molecular geneticist or equivalent qualified personnel.

Clinical Background: Spinal Muscular Atrophy (SMA) is an autosomal recessive neuromuscular disorder characterized by muscle weakness and atrophy resulting from progressive degeneration and loss of the anterior horn cells in the spinal cord (i.e., lower motor neurons) and the brain stem nuclei. SMA is a nervous system genetic disorder. The major manifestations of SMA are symmetric limb proximal muscle weakness, muscular atrophy, low muscle tone, tendon response disappear and respiratory failure etc. SMA patients have pathogenic mutations on two alleles of *SMN1* gene on chromosome 5, which lead to loss of function of SMN1 protein, approximately 95% of affected patients have homozygous deletion of exon 7 of the *SMN1* gene with population carrier frequency up to 1 in 41. *SMN2*, a *SMN1* homologous gene in human genome, encodes SMN2 protein which can compensate the function of SMN1. The number of *SMN2* copies has been shown to modify the clinical phenotype of SMA patient. Generally, patients with more copy number of *SMN2* have milder clinical phenotype.

Technical Principal: This assay is based on real-time fluorescent quantitative PCR. In order to evaluate copy numbers of the *SMN1* gene, MGB probes and specific primers are used to target exon7 of the *SMN1* gene, and human *RPP30* gene is used as internal reference. Also, the amplification of *SMN2* gene has been blocked simultaneously.

Samples requirement: Human genomic DNA extracted from the following specimens.

1. EDTA anti-clotted peripheral blood
2. Prenatal samples:
   1) Cultured amniotic fluid cells on 16th week of gestation or later, without maternal cell contamination
   2) Cultured chorionic villi free from maternal cell contamination

Storage condition:

1. Stored at -20°C, protected from light, valid for 24 months
2. Stored at 4°C, protected from light, valid for 12 months

Clinical performance:

A double-blinded clinical trial was carried out between Apostle SMA-T® *SMN1* and MLPA SMA test kit provided by MRC-Holland (Netherlands), the two kits showed similar sensitivity and specificity in testing *SMN1/SMN2* copy numbers.

APOSTLE

Apostle SMA-T® *SMN2*
Copy number detection kit for human motor neuron survival gene 2 (*SMN2*)
(fluorescence quantitative PCR)

Catalog #: A190919

Size:

A190919-025: Apostle SMA-T® *SMN2*： 25 test/kit
A190919-050: Apostle SMA-T® *SMN2*： 50 test/kit
A190919-100: Apostle SMA-T® *SMN2*： 100 test/kit

Introduction: The Apostle SMA-T® *SMN2* kit is developed for quantitative detection of copy number of human Survival Motor Neuron 2 (*SMN2*) in human genome. When combined with other clinical information, the test results can be used to evaluate the severity and prognosis of Spinal Muscular Atrophy (SMA) patients.

Scope of Application: This kit is designed for research use only. This kit is not intended to be used as a standalone assay for clinical diagnosis. The results of this test must be interpreted and signed off by a clinical molecular geneticist or equivalent qualified personnel.

Clinical Background: Spinal Muscular Atrophy (SMA) is an autosomal recessive neuromuscular disorder characterized by muscle weakness and atrophy resulting from progressive degeneration and loss of the anterior horn cells in the spinal cord (i.e., lower motor neurons) and the brain stem nuclei. SMA is a nervous system genetic disorder. The major manifestations of SMA are symmetric limb proximal muscle weakness, muscular atrophy, low muscle tone, tendon response disappear and respiratory failure et al. SMA patients have pathogenic mutations on two alleles of *SMN1* gene on chromosome 5， that lead to loss of function of SMN1 protein, approximately 95% of affected patients have homozygous deletion of exon 7 of *SMN1* gene with population carrier frequency up to 1 in 41. *SMN2*, a *SMN1* homologous gene in human genome, encodes SMN2 protein which can compensate the function of SMN1. The number of *SMN2* copies has been shown to modify the clinical phenotype of SMA patient. Generally, the patients with more copy number of *SMN2* have milder clinical phenotype.

Technical Principal: This assay is based on real-time fluorescent quantitative PCR. In order to evaluate copy numbers of *SMN2* gene, MGB probes and specific primers are used to target exon7 of the *SMN2* gene, and human *RPP30* gene is used as internal reference. Also the amplification of *SMN1* gene has been blocked simultaneously.

Samples requirement: Human genomic DNA extracted from the following specimens.
1. EDTA anti-clotted peripheral blood
2. Prenatal samples:
   1) Cultured amniotic fluid cells on 16th week of gestation or later, without maternal cell contamination
   2) Cultured chorionic villi free from maternal cell contamination

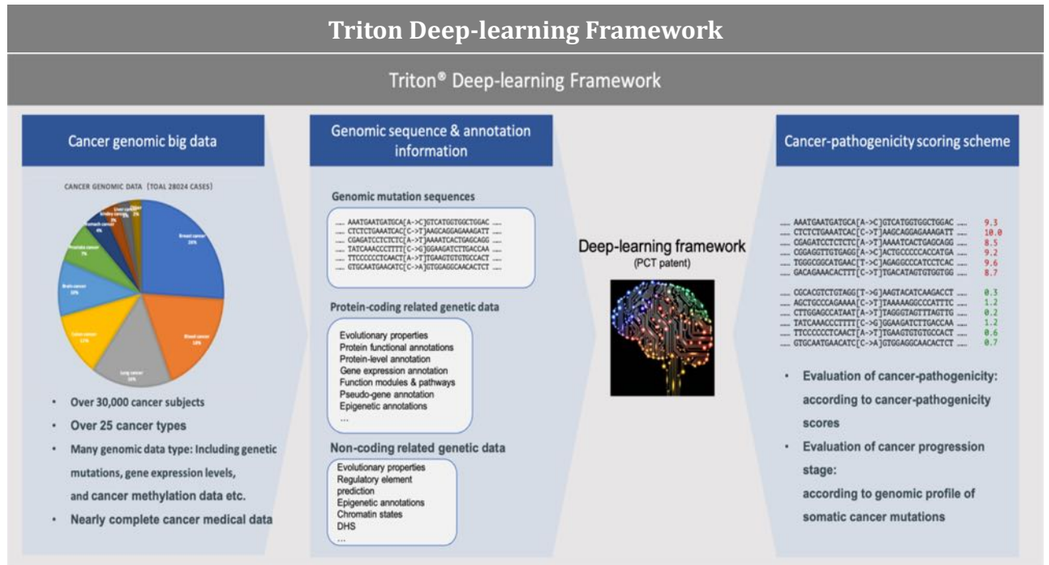
Storage condition:
1. Stored at -20°C, protected from light, valid for 24 months
2. Stored at 4°C, protected from light, valid for 12 months

Clinical performance:
A double-blinded clinical trial was carried out between Apostle SMA-T® *SMN1* and MLPA SMA test kit provided by MRC-Holland (Netherlands), the two kits showed similar sensitivity and specificity in testing *SMN1/SMN2* copy numbers.

Comparison of similar products for SMA Exon deletion testing kits

Products	Apostle SMA-T®kit	MLPA-SMA kit	Domestic similar products
SMA diagnosis	√	√	√
SMA carrier screening	√	√	×
Method	ARMS-qPCR	MLPA	qPCR
Platform	ABI StepOne Plus; ABI 7500, 7900	ABI 3500	ABI StepOne Plus only
SMN1	√	√	√
SMN2	√	√	×
Price	Medium	Medium to high	High

Bioinformatics Analytics Platform



Apostle Triton cfDNA-AI analytics platform

Introduction

Apostle Triton cancer-AI analytics platform includes a variety of cancer genomic data from over 30,000 cancer patients, covering 25 common cancer types. Utilizing a PCT-patented deep-learning computational algorithm, Triton can not only quantitatively evaluate cancer-pathogenicity for any genetic variation, but also accurately predict the overall risk of carcinogenesis and the cancer progression stages of patients from their genomic profiles.

Cancer genomic data：>30,000 cancer patients

Cancer types：25 common cancer types, including breast cancer, lung cancer, and colon cancer etc.

Computation approach：Apostle Triton deep-learning AI framework（PCT patent, 2019）

Clinical applications：Quantitatively evaluate cancer-pathogenicity of genetic variation; evaluate overall risk of carcinogenesis; predict cancer progression stages

Apostle Triton NIPT-AI analytics platform

Introduction

Non-invasive prenatal test (NIPT) is a cfDNA-based prenatal screening test that determines the risk of certain genetic abnormalities of the fetus, from as early as week 10 of pregnancy. Apostle Triton NIPT analytics platform, utilizing the PCT-patented Apostle Triton deep-learning framework, can not only accurately diagnose trisomy 21, trisomy 13, and trisomy 18, but also screen for additional chromosomal disorders that are caused by missing (deleted) or copied (duplicated) sections of a chromosome, as well as many genetic disorders caused by genetic variants.

Clinical application:

- Non-invasive prenatal test (NIPT)

Computational approach:

- Apostle Triton deep-learning framework (PCT patent, 2019)

Genetic data input:

- Low-depth (0.1x – 0.3x) whole-genome sequencing (WGS) NIPT data

Clinical usage:

- Detect trisomy 21 (Down syndrome), trisomy 18 (Edwards syndrome), trisomy 13 (Patau syndrome)
- Detect additional chromosomal disorders, including trisomies 22, 16, and 22q11.2 chromosome deletion (DiGeorge syndrome)
- Detect sex chromosome abnormalities
- Genome-wide analysis of all chromosomes and screen for many known disease-causing genetic variants

Quality Assurance

Apostle offers cutting-edge innovations and exceptional products to meet the specific needs for our clients. Our products are offered by Apostle's team of top chemists, scientists, bioinformaticians, and geneticists, working with a certified quality assurance system.

Apostle Inc is pleased to receive the Certificates of Conformance to certify that Quality Management System of Apostle Inc. has been assessed by ABS Quality Evaluations, Inc. and found to be in conformance with the requirements set forth by: ISO13485:2016, and ISO9001:2015. The Quality Management System is applicable to DEVELOPMENT, MANUFACTURING, LICENSING AND SALES OF CONSUMABLES AND CHEMICALS FOR NUCLEIC ACID RESEARCH

Manufacturing Certification

- ISO 13485
- ISO 9001

In addition, Apostle has a clinical laboratory authorized by the US federal CLIA (CLIA ID 05D2191922), accredited by College of American Pathologists (CAP Number 8830916), with a clinical laboratory license issued by the California state government. Also, Apostle has board-certified clinical molecular geneticist and lab director holding certificates and licenses from American Board of Medical Genetics and Genomics (ABMGG), State of California, State of New York, and diploma from American College of Medical Genetics (ACMG), and Harvard Medical School Genetics Training Program.

Certificates and Licenses

- Clinical Laboratory Improvement Amendments (CLIA) License
- CAP Accreditation
- California Clinical Laboratory License
- American Board of Medical Genetics and Genomics (ABMGG)
- New York State Department of Health Certificate of Qualification for Laboratory Director in Genetic Testing and Oncology
- California State Department of Health License of Clinical Genetic Molecular Biologist

Other recognitions

APR 10, 2023, Apostle MiniMax Technology is cited by a new independent clinical study including 2125 cancer patients, 9 cancer types, using the Apostle Minimax cfDNA technology. This study demonstrates the ability of its model to detect early-stage cancers using cfDNA, including those of pancreatic origin, with high sensitivity that is comparable to that of late-stage detection, published in ***Nature Communication.***

NOV 23, 2022, Apostle MiniMax Technology is cited by another independent clinical study demonstrating the successful clinical utility and validity of the circulating cell-free DNA (cfDNA) analysis for hepatocellular carcinoma (HCC) detection with high sensitivity and specificity, published in ***Science Translational Medicine***.

AUG 18, 2022, Apostle MiniMax Technology is cited by a new independent clinical study, published in ***Nature Medicine*** by a joint clinical team from Gritstone, Columbia University Medical Center, Mayo Clinic, MSKCC, MD Anderson, showing "exploratory biomarker analyses showed decreased circulating tumor DNA (ctDNA) in patients with prolonged OS".

JUN 14, 2022, ***CLINICAL STUDY*** Supports the Use of Liquid Biopsy for Early Diagnosis and Monitoring of Patients with Myeloid Neoplasms, Citing Apostle MiniMax Technology.

APR 11, 2022, Apostle MiniMax Technology is cited by an independent clinical study, published in ***Nature Medicine***, studying safety and tolerability of AAV8 delivery of a broadly neutralizing antibody.

JAN 28, 2022, Performance of Apostle technology is independently validated in an independent study by scientists from Johns Hopkins University and University of Pittsburgh, published in ***SLAS Technology,*** showed that, "(Page 6, Figure 4) Most notably, the Apostle particles outperformed all others, achieving almost 2-fold higher recovery yields than the particles supplied in the X kit".

AUG 30, 2021, Apostle Inc Apostle Diagnostics Laboratory Receives Accreditation from College of American Pathologists.

APR 12, 2021, Apostle RNA Extraction Method is Included in a US FDA EUA Authorized SARS-CoV-2 Molecular Diagnostic Test: Fulgent COVID-19 by RT-PCT Test.

FEB 2, 2021, Apostle MiniMax Technology In Novel Liquid Biopsy Method for Detecting and Monitoring Colon Cancer, Published in ***PNAS.***

SEPT 7, 2020, Apostle MiniEnrich Technology is Published in Royal Society of Chemistry's Analyst.

MAY 24, 2019, Apostle Inc Completes Series A Financing Led by ShangBay Capital, Palo Alto, CA.

FEB 28, 2019, Apostle Inc. Enters Partnership with Beckman Coulter Life Sciences.

APR 3, 2018, Apostle is Elected into the Stanford University StartX Accelerator Program

Reference:

Apostle technologies have been discussed or cited in the following publications:

1. Integrative modeling of tumor genomes and epigenomes for enhanced cancer diagnosis by cell-free DNA. Mingyun Bae, Gyuhee Kim, Tae-Rim Lee, et al. ***Nature Communications*** 14, Article number: 2017 (2023)
(Note: Apostle MiniMax technology is used in this study.)

2. Combining cell-free RNA with cell-free DNA in liquid biopsy for hematologic and solid tumors. Maher Albitar, Hong Zhang, Ahmad Charifa, et al. ***Heliyon*** 9 (2023) e16261; May 16, 2023
(Note: Apostle MiniMax technology is used in this study.)

3. Noninvasive Prenatal Screening for Common Fetal Aneuploidies Using Single-Molecule Sequencing. Yeqing Qian, Yongfeng Liu, Kai Yan, et al. ***Laboratory Investigation*** Volume 103, Issue 4, April 2023, 100043
(Note: Apostle MiniMax technology is used in this study.)

4. Rapid Lineage Assignment of Severe Acute Respiratory Syndrome Coronavirus 2 Cases through Automated Library Preparation, Sequencing, and Bioinformatic Analysis. Andrew J. Gorzalski, Heather Kerwin, Subhash Verma, David C. Hess, Joel Sevinsky, Kevin Libuit, Irina Vlasova-St. Louis, Danielle Siao, Lauren Siao, Diego Buñuel, Stephanie Van Hooser, Mark W. Pandori. ***The Journal of Molecular Diagnostics*** Volume 25, Issue 4, April 2023, Pages 191-196
(Note: Apostle MiniGenomics, Apostle MagTouch technologies are used in this study.)

5. Cell-free chromatin immunoprecipitation can determine tumor gene expression in lung cancer patients. Christoffer Trier Maansson, Peter Meldgaard, Magnus Stougaard, Anders Lade Nielsen, Boe Sandahl Sorensen. ***Molecular Oncology***. February 24, 2023. DOI: 10.1002/1878-0261.13394.
(Note: Apostle MiniMax technology is used in this study.)

6. Automatic Separation and Collection of Cancer-Related Substances from Clinical Samples. Jin-Han Bae, Jay Jeong, Byung Chul Kim, et al. ***Journal of Visualized Experiments***. January 13th, 2023. DOI: 10.3791/64325
(Note: Apostle MiniMax technology is used in this study.)

7. Individualized, heterologous chimpanzee adenovirus and self-amplifying mRNA neoantigen vaccine for advanced metastatic solid tumors: phase 1 trial interim results. Christine D. Palmer, Amy R. Rappaport, Matthew J. Davis, et al. ***Nature Medicine*** volume 28, pages 1619–1629 (2022)
(Note: Apostle MiniMax technology is used in this study.)

8. Simultaneous analysis of mutations and methylations in circulating cell-free DNA for hepatocellular carcinoma detection. Pei Wang1†, Qianqian Song1†, Jie Ren2†, Weilong Zhang1,3†, Yuting Wang1,4, Lin Zhou2, Dongmei Wang1,4, Kun Chen4, Liping Jiang1, Bochao Zhang2, Wanqing Chen5, Chunfeng Qu1,4*, Hong Zhao6*, Yuchen Jiao1*. ***Science Translational Medicine*** 14, eabp8704 (2022) 23 November 2022
(Note: Apostle MiniMax technology is used in this study.)

9. Safety and tolerability of AAV8 delivery of a broadly neutralizing antibody in adults living with HIV: a phase 1, dose-escalation trial. Casazza JP, Cale EM, et al. the VRC603 Study Team. ***Nature Medicine*** April 11, 2022.
(Note: Apostle MiniMax technology is used in this study.)

10. Comparative analysis of cell-free DNA extraction efficiency from plasma. Beckman Coulter Life Sciences. Indianapolis, IN. ***Technical Note*** 2022.
(Note: Apostle MiniMax technology is compared and discussed in this study.)

11. Reliability of Cell-Free DNA and Targeted NGS in Predicting Chromosomal Abnormalities of Patients With Myeloid Neoplasms. Andrew Ip, Alexandra Della Pia, Gee Youn (Geeny) Kim, Jason Lofters, James Behrmann, Dylon Patel, Simone Kats, Jeffrey Justin Estella, Ivan De Dios, Wanlong Ma, Andrew L. Pecora, Andre H. Goy, Jamie Koprivnikar, James K. McCloskey and Maher Albitar. ***Frontiers in Oncology*** June 14, 2022; https://doi.org/10.3389/fonc.2022.923809
(Note: Apostle MiniMax technology is used in this study.)

12. Quantifying Fetal DNA in Maternal Blood Plasma by ddPCR Using DNA Methylation. E. Hall, T. Riel, M. Ramesh, M. Gencoglu, O. Mikhaylichenko, R. Dannebaum, S. Margeridon, M. Herrera. Bio-Rad Laboratories, Pleasanton, CA. ***Association for Molecular Pathology 2022 Annual Meeting Abstracts. J Mol Diagn*** 2022, 24:S1 Abstract G072. (Full Abstract List) (G072 Only)
(Note: Apostle MiniMax technology is used in this study.)

13. Next-Generation Digital Polymerase Chain Reaction: High-Dynamic-Range Single-Molecule DNA Counting via Ultrapartitioning. Eleen Y. Shum, Janice H. Lai, Sixing Li, Haeun G. Lee, Jesse Soliman, Vedant K. Raol, Cavina K. Lee, Stephen P.A. Fodor, H. Christina Fan ***Anal. Chem.*** *2022, Publication Date:December 12, 2022.*
(Note: Apostle MiniMax technology is used in this study.)

14. A method for early diagnosis of lung cancer from tumor originated DNA fragments using plasma cfDNA methylome and fragmentome profiles. Yeo Jin Kim, Hahyeon Jeona, Sungwon Jeon, et al. ***Molecular and Cellular Probes*** Volume 66, December 2022
(Note: Apostle MiniMax technology is used in this study.)

15 Nicotine dose-dependent epigenomic-wide DNA methylation changes in the mice with long-term electronic cigarette exposure. Gang Peng,* Yibo Xi,* Chiara Bellini, Kien Pham, Zhen W Zhuang, Qin Yan, Man Jia, Guilin Wang, Lingeng Lu, Moon-Shong Tang, Hongyu Zhao, and He Wang ***American Journal of Cancer Research.*** Volume 12, Issue 8, August 2022, Pages 3679–3692.
(Note: Apostle MiniMax technology is us in this study.)

16. High-throughput sample processing for methylation analysis in an automated, enclosed environment. Alejandro Stark, Thomas R. Pisanic, James G. Herman, Tza-Huei Wang. ***SLAS Technology*** Volume 27, Issue 3, June 2022, Pages 172-179.
(Note: Apostle MiniMax technology is compared and discussed in this study.)

17. Detecting SARS-CoV-2 variants in wastewater and their correlation with circulating variants in the communities. Lin Li, Timsy Uppal, Paul D. Hartley, Andrew Gorzalski, Mark Pandori, Michael A. Picker, Subhash C. Verma & Krishna Pagilla. ***Scientific Reports*** volume 12, Article number: 16141 (2022) , September 2022
(Note: Apostle MiniGenomics technology is used in this study.)

18. Optimalizace digitální polymerázové řetězové reakce pro aplikaci v neinvazivní prenatální diagnostice (Optimization of digital polymerase chain reaction for application in non-invasive prenatal diagnostics) Author: Šenkyřík, Pavel; Advisor: Korabečná, Marie; Referee: Vodička, Radek; Faculty / Institute: Faculty of Science; Discipline: Anthropology and Human Genetics; Department: Department of Anthropology and Human Genetics; Date of defense: 13. 9. 2022; Publisher: Univerzita Karlova, Přírodovědecká fakulta; Language: Czech
(Note: Apostle MiniMax technology is discussed in this diploma thesis.)

19. Rapid repeat infection of SARS-CoV-2 by two highly distinct delta-lineage viruses. Andrew J. Gorzalski , Christina Boyles, Victoria Sepcic, Subhash Verma, Joel Sevinsky, Kevin Libuit, Stephanie Van Hooser, Mark W. Pandori. ***Diagnostic Microbiology and Infectious Disease*** Volume 104, Issue 1, September 2022, 115747; https://doi.org/10.1016/j.diagmicrobio.2022.115747
(Note: Apostle MagTouch technology is used in this study.)

20. Response prediction and risk stratification of patients with rectal cancer after neoadjuvant therapy through an analysis of circulating tumour DNA. Liu W, Li Y, et al. ***EBioMedicine*** March 17, 2022; https://www.thelancet.com/journals/ebiom/article/PIIS2352-3964(22)00129-3/fulltext
(Note: Apostle MiniMax technology is used in this study.)

21. A microfluidic platform for high-purity cell free DNA extraction from plasma for non-invasive prenatal testing. Lindsay Schneider, Thomas Usherwood, Anubhav Tripathi. ***Prenatal Diagnosis*** January 14, 2022; https://doi.org/10.1002/pd.6092
(Note: Apostle MiniMax technology is discussed in this study.)

22. Direct capture and sequencing reveal ultra-short single-stranded DNA in biofluids. Cheng et al. ***iScience.*** 2022; In Press.
(Note: Apostle MiniMax technology is discussed in this study.)

23. Nanostructures in non-invasive prenatal genetic screening. Samira Sadeghi, Mahdi Rahaie & Bita Ostad-Hasanzadeh. ***Biomedical Engineering Letters*** volume 12, pages 3–18 (2022)
(Note: Apostle MiniEnrich technology is reviewed in this review article.)

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