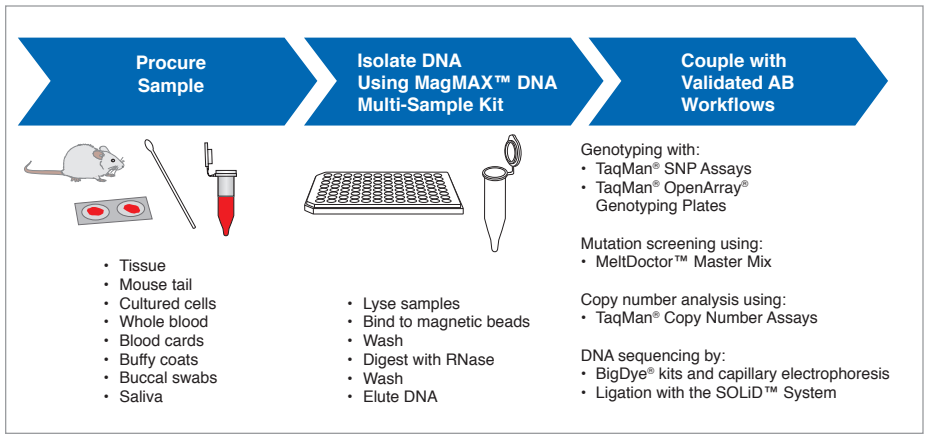
MagMAX™ DNA Multi-Sample Kits

- High yields of highly pure DNA—obtain maximal yields of high-quality DNA for use in routine or stringent downstream applications
- Compatible with a wide range of sample types—purify DNA samples such as blood, blood cards, and buffy coats; tissue samples such as mouse tails and buccal swabs; and cultured cells
- Efficient magnetic particle technology—superior solution-phase binding and washing kinetics facilitate DNA purification, sample handling, and automation
- Ideal for Applied Biosystems genetic analysis workflows—including SNP and copy number assays, high-throughput genotyping, CE and next generation sequencing, and high resolution melting analysis



Compatibility of MagMAX™ DNA Multi-Sample Kits with Genetic Analysis Workflows.

DNA, the blueprint of life, was first isolated 140 years ago, long before its role was elucidated. However, our understanding of DNA has evolved to enable its use in human identification, genetic testing and profiling, as well as drug design and gene therapeutics.

Critical and foremost to all DNA-based research is the release and purification of nucleic acid from matrices in which it is stored, e.g., tissue, blood, buccal swabs, or cultured cells. The quantity and quality of the purified genomic DNA can greatly impact the success of the sample analysis process and the overall quality of the final result. The MagMAX™ DNA Multi-Sample Kits provide a consistent, reliable method, based on magnetic-particle technology, enabling the rapid purification of highly pure DNA. Magnetic particles offer several advantages over other purification methods, including a flexible format that is easily scalable and automatable, as well as better binding and washing efficiencies than filter membrane–based methods, resulting in cleaner, more abundant nucleic acid that is compatible with most downstream applications.

High Yields of Highly Pure DNA From Multiple Sample Types

The demands for DNA yield and purity have become more stringent with the development of new analytical methods and technologies, such as high-throughput genotyping and next generation DNA sequencing platforms. MagMAX™ DNA Multi-Sample Kits meet the challenge by delivering highly pure DNA free of nucleases, proteins, and other inhibitors of downstream enzymatic reactions.

As shown in Table 1 and Table 2, high DNA yield and purity can be obtained from diverse sample types such as heparinized blood and spleen tissue, all from a single kit (versus separate kits for each sample type). MagMAX™ DNA Multi-Sample Kits offer the flexibility of processing samples in tubes (manually) or in 96-well plates (manually or automated).

For applications requiring maximal yields, for small batch sizes, or for DNA archival purposes, the tube format may be desirable because of the large sample input compatibility; DNA yields suitable for most routine applications can be obtained using the 96-well plate format (Table 1).

Efficient Magnetic Particle Technology

The ability to purify high yields of high-quality DNA with MagMAX™ DNA Multi-Sample Kits is enabled by advanced magnetic particle chemistry. The large surface area of the magnetic particles and the solution binding kinetics facilitate efficient DNA binding. These same properties also facilitate superior washing and elution: bound DNA directly contacts the wash buffer to maximize contaminant removal, and beads require significantly lower elution volumes than filter membranes. This results in cleaner, more abundant, and more concentrated DNA. Furthermore, there is no centrifugal or vacuum filtration required, virtually eliminating aerosolization that can lead to cross-contamination. The protocol can easily be scaled up to accommodate both larger sample input as well as larger sample numbers, and is easily adapted to many automated platforms, including MagMAX™ Express, Beckman Coulter™, Tecan®, and Caliper™ instrumentation, making it ideal for larger multi-sample, multivariate, or multi-replicate experiments.

The ability to purify sufficient quantities of DNA from limited, precious, or even routine samples can impact many downstream applications. Figure 1 demonstrates the ability of the MagMAX™ DNA Multi-Sample Kit to recover high yields of DNA from lipid or glycogen-rich samples, such as brain and liver tissues, respectively. In this investigation, more than twice as much DNA was purified from tissues with the MagMAX™ DNA Multi-Sample Kit than with a leading competitor's filter membrane–based method.

Molecular biology applications are typically driven by enzymatic reactions that are susceptible to inhibition by analytes carried over from the sample matrix (e.g., heme, heparin, salts, protein) or the purification method itself (phenol, salts, alcohol). Figure 2 illustrates the effect of DNA purity on real-time PCR. DNA was extracted from anticoagulated EDTA or heparinized whole blood with the MagMAX™-96 DNA Multi-Sample Kit, or a filter membrane–based kit from Competitor Q. Equivalent mass amounts of DNA from each sample were subjected to real-time PCR analysis for the RNase P gene. As shown in Figure 2, the C_t values for the DNA purified using the MagMAX™ DNA Multi-Sample Kit were 0.4 to 1.2 C_t lower than those generated from DNA purified with a filter membrane from Competitor Q, for both EDTA and heparinized whole blood. The lower C_t values demonstrate the absence of qPCR inhibitors in reactions that contained samples purified using the MagMAX™ kit. This is an indication that the magnetic particle tech-

Table 1. DNA Yield From MagMAX™ DNA Multi-Sample Kits.

	Single Tube		96-Well Plate	
Sample	**Input**	**Average Yield**	**Input**	**Average Yield**
Mouse Brain	50 mg	80–100 µg	10 mg	20–22 µg
Mouse Liver	50 mg	320–360 µg	10 mg	93–103 µg
Mouse Spleen	25 mg	275–350 µg	5 mg	130–155 µg
Mouse Thymus	25 mg	240–350 µg	5 mg	112–212 µg
Mouse Tail	1 cm piece	58–63 µg	0.5 cm piece	49–56 µg
HeLa Cells	5 x 10^6 cells	116–126 µg	1 x 10^6 cells	17–27 µg
Buffy Coat	200 µL	110–128 µg	50 µL	15–17 µg
Human Blood (plus EDTA)	200 µL	7–11 µg	50 µL	1.5–2.0 µg
Human Blood (plus heparin)	200 µL	8–12 µg	50 µL	2.5–4.0 µg
Human Blood (plus sodium citrate)	200 µL	8–10 µg	50 µL	1.7–3.0 µg
Buccal Cells	1 swab	0.5–1.0 µg	1 swab	0.5–1.0 µg
Mouse Blood (plus EDTA)	50 µL	1.2–1.7 µg	50 µL	1.2–1.7 µg
SS Blood Card	2 x 2 mm punches	0.1–0.3 µg	2 x 2 mm punches	0.1–0.3 µg
FTA Blood Card	2 x 2 mm punches	0.3–0.5 µg	2 x 2 mm punches	0.3–0.5 µg

DNA from hair follicles, saliva, and bovine blood has also been successfully isolated. Visit www.appliedbiosystems.com/magmax for the most up-to-date information.

Table 2. Performance of MagMAX™ DNA Multi-Sample Kits.

Metric	Performance
A260/280	1.7–1.9
RNA contamination	Not detectable
DNA integrity	≥23 kb
Mean CV, DNA yield	16%
Time to complete protocol (96 samples)	≤60 min
Automated platform scripts available	MagMAX™ Express-96 Deep Well with pre-loaded protocol • Visit www.appliedbiosystems.com/magmax for the most up-to-date information.
Available formats	50 preps, manual (2 mL tube) • 96 preps, manual (microwell plate) • 96 preps, automated (microwell plate)

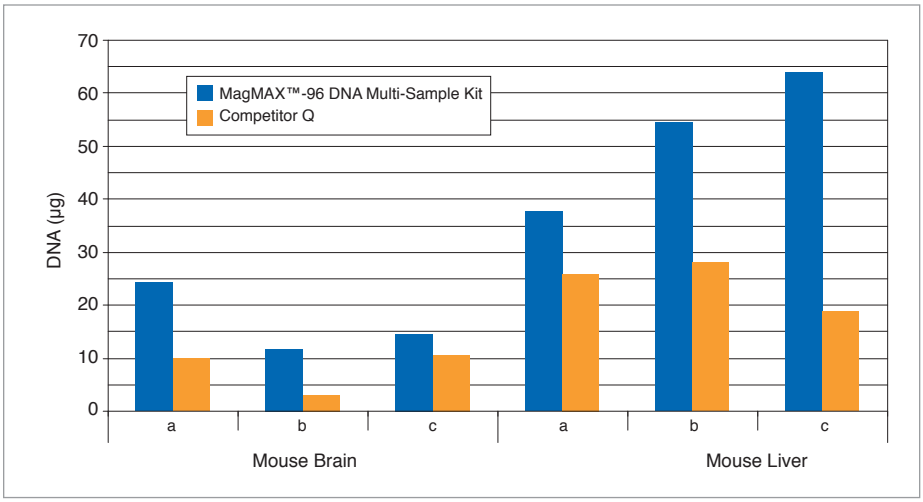


Figure 1. Improved Yield With MagMAX™-96 DNA Multi-Sample Kit Compared to Filter Membrane Method. DNA was extracted from 10 mg each of 3 biological samples from mouse brain or liver tissue using the MagMAX™-96 DNA Multi-Sample Kit, or a filter membrane–based kit from Competitor Q. Concentration was measured using OD_{260} values from the Nanodrop™ spectrophotometer, and yield (µg) was calculated by multiplying the elution volume with the concentration measurement. Despite having a larger elution volume, the filter-based method showed a lower recovery than the MagMAX™-96 DNA Multi-Sample Kit.

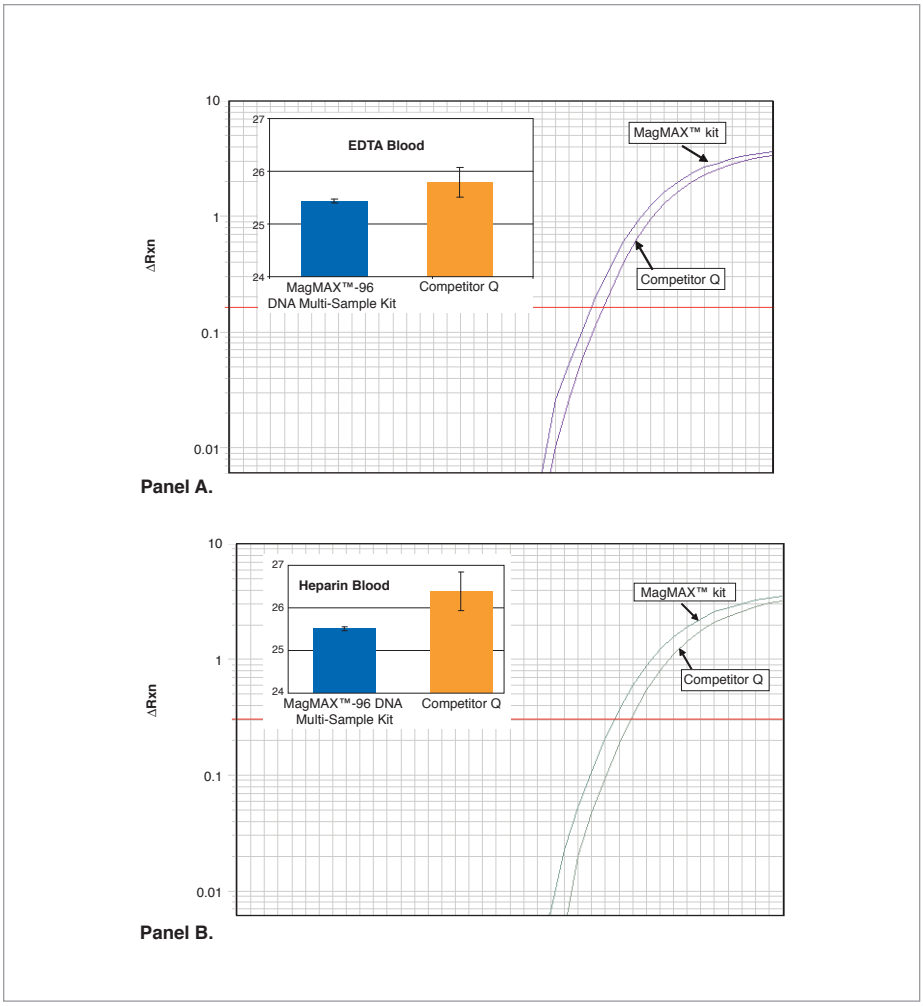


Figure 2. The Effect of DNA Purity on Quantitative PCR (qPCR) Sensitivity From EDTA and Heparinized Anticoagulated Whole Blood. DNA was extracted from 3 anticoagulated EDTA (A) or heparinzed (B) whole blood samples using the MagMAX™-96 DNA Multi-Sample Kit or a filter membrane–based kit from Competitor Q. Equivalent mass amounts of each sample were run in duplicate qPCR reactions for the RNase P target. The EDTA and heparinized blood samples purified using the MagMAX™-96 DNA Multi-Sample Kit magnetic bead–based method produced lower raw C_t values for both samples, indicating cleaner samples. Representative amplification plots and mean results (inset) are shown.

nology in the MagMAX™ kit facilitates better DNA-binding kinetics and efficient washing, resulting in cleaner DNA.

Ideal for Applied Biosystems Genetic Analysis Workflows

Applied Biosystems has been the premier provider of genetic analysis instruments and reagents to academia and industry for more than 25 years. Genetic analysis applications currently offered by Applied Biosystems include the TaqMan® OpenArray® Genotyping System, TaqMan® SNP Genotyping Assays, TaqMan® Copy Number Assays, MeltDoctor™ High Resolution Melt (HRM) Reagents, BigDye® capillary electrophoresis sequencing, and SOLiD™ System next generation sequencing. MagMAX™ DNA Multi-Sample Kits are the first choice, and the first step, for routine as well as demanding DNA-based applications, and are suitable for a variety of Applied Biosystems application workflows (see schematic on Page 1).

SNP Genotyping

To demonstrate the compatibility of the MagMAX™ DNA Multi-Sample Kits with TaqMan® SNP Genotyping workflows, heparinized whole blood was collected from 46 separate donors and DNA was purified using the MagMAX™ -96 DNA Multi-Sample Kit on the MagMAX™ Express-96 Deep Well Magnetic Particle Processor. Each DNA sample was analyzed using 4 different TaqMan® SNP Genotyping Assays. These assays are highly robust; however, DNA mass and purity must be sufficient to yield highly accurate and reproducible allelic discrimination. Figure 3 shows the cluster plots generated with the 4 representative SNP targets tested. The call rate was 100% for each sample, and the MCSS (cluster separation) was greater than 10 for all assays (representative data shown), indicative of high assay sensitivity and the ability to accurately detect the intended polymorphisms. Similar results were obtained on the high-throughput genotyping TaqMan® OpenArray® System (data not shown).

DNA Sequence Analysis

DNA extraction is a critical first step in the experimental workflow of DNA sequence analysis. The quality, accuracy, and length of the DNA sequence read can be significantly affected by the tissue type (including blood), how it was obtained from its source, and how the sample was handled or stored prior to extraction, as well as the method chosen for nucleic acid extraction. It is important to mini-

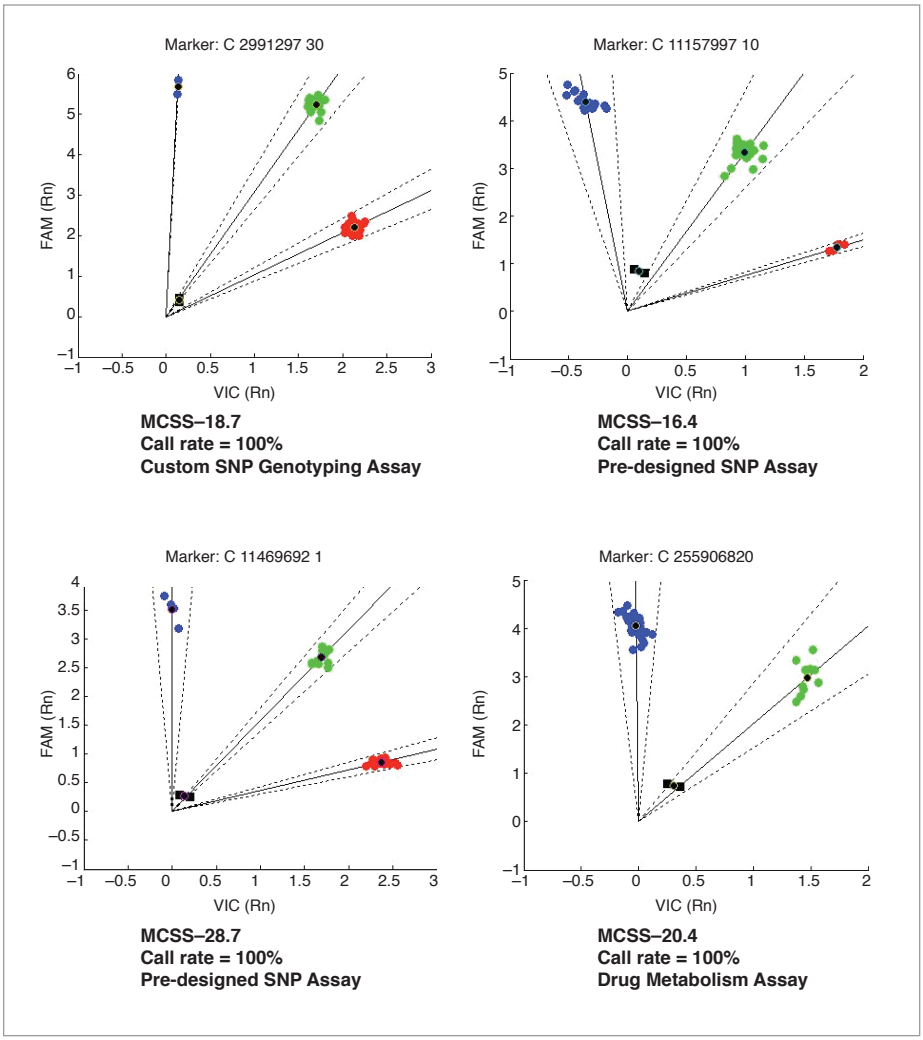


Figure 3. Genotyping Results for Heparin Blood Samples Isolated Using the MagMAX™-96 DNA Multi-Sample Kit. Heparinized, anticoagulated whole blood was collected from 46 separate donors and stored at –20°C. DNA was isolated using the MagMAX™-96 DNA Multi-Sample Kit automated protocol on the MagMAX™ Express-96 Deep Well Magnetic Particle Processor. SNP genotyping was performed with 5 ng of each sample using TaqMan® SNP Assays and TaqMan® GTXpress™ Master Mix. Results are shown as cluster plots. The allelic call rate was 100%, and the MCSS (cluster separation) was greater than 10 for all assays, indicating robust reactions with the input DNA.

mize DNA degradation by avoiding freeze/thaw cycles, exposure to heat or light, and vortexing.

To test the ability of the MagMAX™ DNA Multi-Sample Kit to purify high-quality DNA required for sequence analysis, purified DNA from heparinized whole blood samples stored at –20°C was subjected to Fast PCR sequencing using VariantSEQr® primer pairs and BigDye® Terminator v3.1 reagent, followed by capillary electrophoresis on the Applied Biosystems® 3130*xl* Genetic Analyzer. Figure 4 shows the results; a sufficient quantity and quality of genomic DNA was isolated with the MagMAX™ DNA Multi-Sample Kit to generate excellent DNA sequencing data. High-quality scores in excess of 500 nucleotide reads were obtained with whole blood samples stored under challenging conditions, further attesting to the robustness of the MagMAX™ chemistry to deliver high-quality DNA for routine as well as stringent applications.

MagMAX™ DNA Multi-Sample Kit Formats

The MagMAX™ DNA Multi-Sample Kits are available for manual use or for automated platforms. The kits contain sufficient reagents for purifying DNA from 50 samples using microfuge tubes; MagMAX™-96 DNA Multi-Sample Kits can be used for manual or automated processing of up to 96 samples simultaneously in microwell plates. Magnetic Stands are available separately in several formats for manual processing. Alternatively, the MagMAX™-96 DNA Multi-Sample Kit instruction manual contains protocols for automated processing on the MagMAX™ Express-96 Deep Well Magnetic Particle Processor.

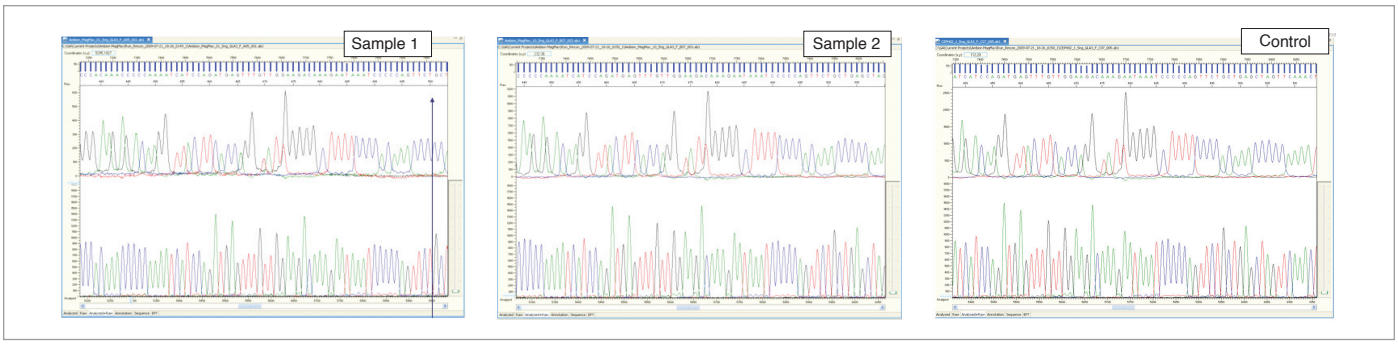


Figure 4. Fast PCR Sequencing Results From DNA Purified Using the MagMAX™ DNA Multi-Sample Kit. Heparinized, anticoagulated whole blood was collected from 10 separate donors and stored at –20°C. DNA was isolated from each sample using the MagMAX™ DNA Multi-Sample Kit. DNA samples (5 ng) were sequenced using the Fast PCR Sequencing Protocol with VariantSEQr® primer pairs and BigDye® Terminator v3.1 reagent followed by capillary electrophoresis on the Applied Biosystems® 3130*xl* Genetic Analyzer. Base calling was performed with the Seq Analysis 5.2 software, and results were viewed with Sequence Scanner v.1.0 software. Applied Biosystems® CEPH 1347-02 reference DNA served as a control. The top half of each sequence trace represents the raw data while the lower half represents processed data. The data show that genomic DNA isolated with the MagMAX™ DNA Multi-Sample Kit performed comparably with the control. High-quality scores in excess of 500 nucleotide reads were obtained. Representative data are shown.

ORDERING INFORMATION

Description	Size	Part Number
MagMAX™ DNA Multi-Sample Kit	50 preps	4413020
MagMAX™-96 DNA Multi-Sample Kit	96 preps	4413021
MagMAX™-96 DNA Multi-Sample Kit	5 x 96 preps	4413022
6-Tube Magnetic Stand	1 stand	AM10055
Magnetic Stand-96	1 stand	AM10027
96-well Magnetic Ring Stand	1 stand	AM10050
MagMAX™ Express-96 Deep Well Tip Combs	100 pieces	4388487
MagMAX™ Express-96 Deep Well Plates	50 plates	4388476
MagMAX™ Express-96 Deep Well Magnetic Particle Processor	1 instrument	4400077

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