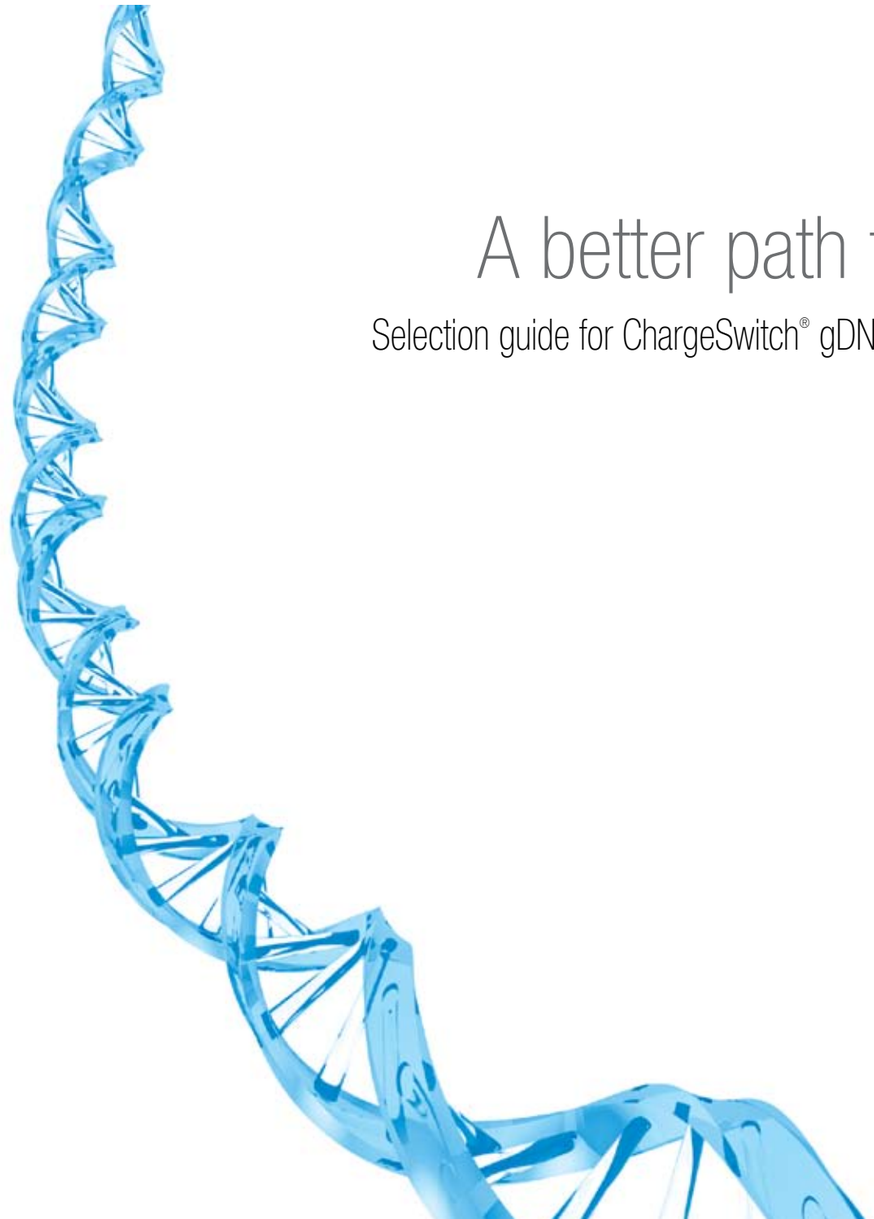

# A better path to purity

## Selection guide for ChargeSwitch® gDNA Purification Kits

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# ChargeSwitch® gDNA Kits—a major technological advance in DNA purification

- → Low-salt, water-based buffers deliver purified nucleic acid without contaminating substances
- → Effectively purifies nucleic acid from fresh or frozen whole blood, serum, tissue, forensic and clinical samples, plants, and bacteria
- → Ideal for high-throughput applications and for instances where the starting material is very limited

Research investigations of all types routinely rely on modern genome-scanning methods such as single nucleotide polymorphism (SNP)–based associations and short tandem repeat (STR) linkage analysis. Regardless of the test to be performed, genotyping and identity testing studies begin with the isolation of genomic DNA (gDNA) from the source organism. These starting materials are sometimes difficult to process if the sample is degraded, the target molecule is harvested from tough tissues such as plant seeds and mouse tails, or, in the case of forensic samples, the starting material is scarce. PCR-based methods like SNP and STR analysis require DNA to have a purity level that can be difficult to achieve using conventional methods.

Conventional gDNA purification methods involve salting out with harsh organic solvents, anion exchange, and silica-based extraction that can compromise subsequent DNA processing in sensitive applications. Until the late 1990s, little progress had been made in new developments of nucleic acid purification to keep pace with the unprecedented range of demanding applications in the life sciences.

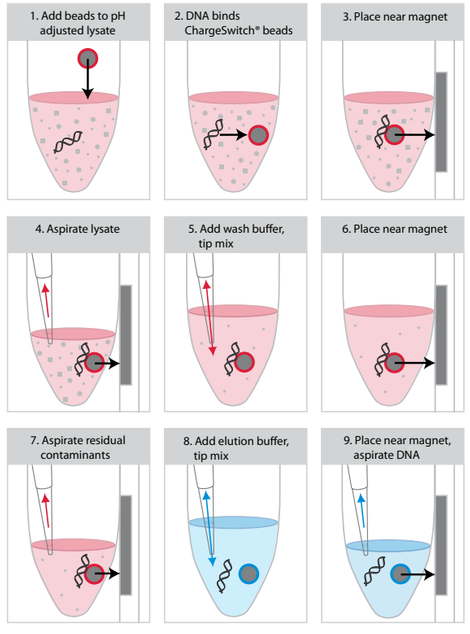



Figure 1—Workflow of ChargeSwitch® DNA purification technology.

## ChargeSwitch® technology delivers high-quality gDNA samples without solvents or chaotropic salts

The basis of the ChargeSwitch® nucleic acid purification technology is a switchable surface charge (Figure 1). In conditions of pH<6.5, the ChargeSwitch® surface has a positive charge that selectively binds the negatively charged nucleic acid backbone. Proteins and other contaminants are removed in an aqueous wash buffer. For elution, the charge on the ChargeSwitch® surface is switched off by raising the pH to 8.5. Purified nucleic acid elutes instantly and is ready for downstream use. The ChargeSwitch® technology method uses low-salt, water-based buffers and avoids the introduction of organic solvents, ethanol, or concentrated chaotropic salts. ChargeSwitch® technology is particularly useful for purification of nucleic acids from limited samples, yields nucleic acids of the highest quality (without carryover of substances which interfere with downstream applications), and is ideal for high-throughput applications.

## Effects of contaminants on downstream applications

The inhibitory reagents used in most techniques currently used for purifying gDNA from blood are difficult to detect when measuring DNA quality on gels or by UV spectrophotometry. Data show, however, that even low levels of alcohols or chaotropic salts can completely inhibit thermostable polymerase activity, causing PCR reactions to fail. The ChargeSwitch® technology uses 100% aqueous solutions, which eliminate the possibility of PCR failure due to the presence of ethanol, phenol, chloroform, and ionic chaotropes. Contaminants carried over from traditional gDNA purification methods and from competitors' wash buffers inhibit not only PCR (Figure 2), but also restriction enzyme digestion (Figure 3) and sequencing reactions (Figure 4).

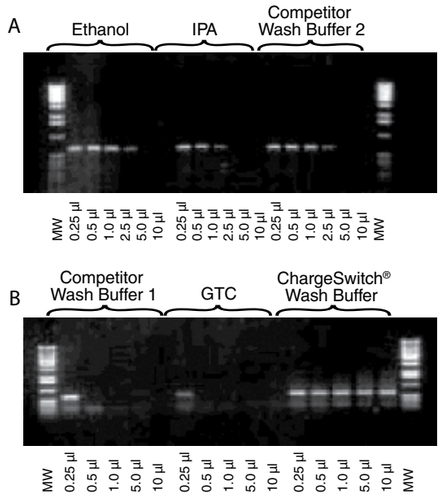



Figure 2—PCR amplification performed in the presence of contaminants. **A:** The actin gene was amplified by PCR from human placental DNA (Sigma) in a 50 µl reaction spiked with varying volumes of ethanol, isopropanol (IPA), and a competitor's wash buffer. For each reaction, 10 µl of amplified product was run on a 1% agarose gel and stained with ethidium bromide. **B:** The actin gene was amplified by PCR from human placental DNA (Sigma) in a 50 µl reaction spiked with varying volumes of a competitor's wash buffer, guanidinium isothiocyanate (GTC), and ChargeSwitch® Wash Buffer. For each reaction, 10 µl of amplified product was run on a 1% agarose gel and stained with ethidium bromide. MW: 1 Kb DNA Ladder.

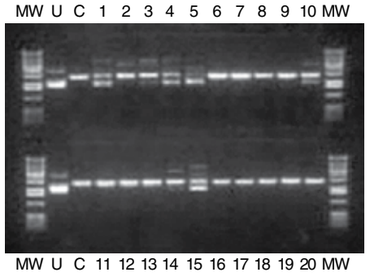



Figure 3—Restriction endonuclease reactions performed in the presence of contaminants. A series of restriction endonuclease digestions were carried out in the presence of low levels of ethanol, competitors' wash buffers, and with ChargeSwitch® Wash Buffer to demonstrate any inhibitory effects. In all samples, 1 µg of pUC19 (NEB) was digested in a 20 µl reaction using 1 unit of *Hind* III enzyme for 1 hr at 37°C. **MW:** 1 Kb DNA Ladder; **U:** uncut 1 µg pUC19; **C:** *Hind* III cut pUC19; **Lanes 1–5:** 0.25, 0.5, 1, 2.5, and 5 µl Competitor 1 wash buffer; **Lanes 6–10:** 0.25, 0.5, 1, 2.5, and 5 µl Competitor 2 wash buffer; **Lanes 11–15:** 0.25, 0.5, 1, 2.5, and 5 µl ethanol; **Lanes 16–20:** 0.25, 0.5, 1, 2.5, and 5 µl ChargeSwitch® Wash Buffer.

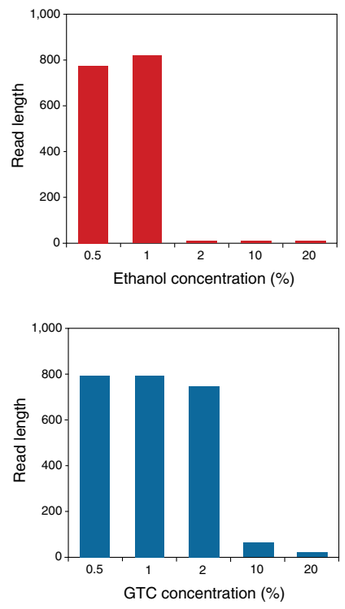



Figure 4—Sequencing reaction performance in the presence of contaminants. 5 µg of pUC19 plasmid DNA (NEB) was treated with ethanol or guanidinium isothiocyanate (GTC) to a final concentration of 0.5, 1, 2, 10, and 20%. 2 µl of the treated DNA was used in a BigDye® Terminator v1.1 sequencing reaction with 10 pmol of pUC19 forward primer and resolved on a 3730 DNA Analyzer (Applied Biosystems). Sequence scoring for ethanol and GTC experiments was carried out using Lasergene® software (DNASTAR, Inc.) and Phred software (University of Washington), respectively.

## Optimized performance for specific sample types

The ChargeSwitch® technology delivers clean gDNA in less than 15 min after sample lysis. Because DNA isolation is achieved without phenol, ethanol, chloroform, ionic chaotropes, and enzymatic inhibitors, the purified gDNA demonstrates improved downstream performance in many applications, including PCR and qPCR, STR and SNP analysis, restriction enzyme digestion, and Southern blotting. In addition, because most ChargeSwitch® and GeneCatcher™ purification protocols do not require centrifugation, biohazardous aerosols that can occur during centrifugation are eliminated when these kits are used (see page 6 for information on GeneCatcher™ technology). The ChargeSwitch® and GeneCatcher™ technology is available in a variety of kits for gDNA purification from sample types including fresh or frozen whole blood, serum, tissue, forensic and clinical samples, plants, and bacteria. Use Table 1 to assist you in choosing the right product for your sample.

## ChargeSwitch® EasyPlex™ and Direct 96 and 8-well gDNA Kits

The newest additions to the ChargeSwitch® product line are the ChargeSwitch® Direct 96 and EasyPlex™ gDNA Kits. The ChargeSwitch® surface is now available coated on the wells of a 96-well plate for easy and direct sample processing for PCR or qPCR without the need to elute the DNA. The blood sample or cells are mixed in the well with lysis buffer, and the DNA binds to the charged surface while contaminants are washed away. Reaction buffer and enzyme are added directly to the wells containing the bound DNA for direct amplification of the purified product (Figure 5). The plate fits in all 96-well thermal cyclers and real-time cyclers to allow for rapid processing of the gDNA. The ChargeSwitch®-coated plates eliminate extra handling and pipetting steps that can lead to sample mix-ups or contamination. In addition, unlike other direct lysis–based systems, no dilution of the DNA is required, so you can maximize the amount of template available for the reaction and achieve greater sensitivity.

If you work in a basic research environment, you may choose either our EasyPlex™ gDNA Kits or our ChargeSwitch® Direct 96 Kits. If you work in a GMP-regulated environment, choose one of our ChargeSwitch® EasyPlex™ Kits, which include GMP-manufactured ChargeSwitch® coated plates.

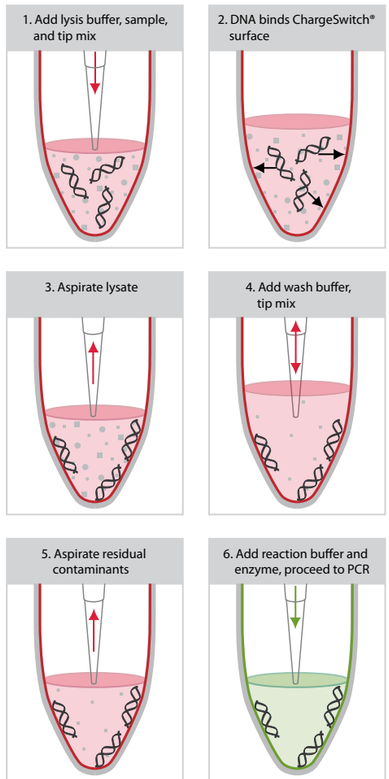



Figure 5—Rapid purification of gDNA from blood or cells using the ChargeSwitch® EasyPlex™ and Direct gDNA Kits in 96-well plates.

Table 1—Product selection guide for ChargeSwitch® and GeneCatcher™ gDNA Purification Kits.

| Product name | Sample type and amount | Lysis time | Elution volume | Yield | Cat. no. |
|---|---|---|---|---|---|
| ChargeSwitch® gDNA 50–100 µl Blood Kit | 50–100 µl fresh, frozen, EDTA- or citrate-treated human blood | 10 min | 40–150 µl | up to 3 µg | CS11000<br>CS11000-10 |
| GeneCatcher™ gDNA Blood Kit, 0.3–1 ml | 0.3–1 ml fresh, frozen, old/archived, EDTA- or citrate-treated human blood | 15 min | 60–250 µl | up to 30 µg | CS21101 |
| GeneCatcher™ gDNA Blood Kit, 3–10 ml | 3–10 ml fresh, frozen, old/archived, EDTA- or citrate-treated human blood | 15 min | 1 ml | up to 300 µg | CS21110 |
| ChargeSwitch® Direct 96 and ChargeSwitch® EasyPlex™ gDNA Kits | 1–2 × $10^4$ cells or 10 µl whole blood | 30 min | No elution necessary; amplify directly in the well§ | ~50 ng/well, depending on the sample type | CS11205<br>CS11206<br>CS11207<br>CS11208 |
| ChargeSwitch® gDNA 1 ml Serum Kit | 0.2–1 ml human serum | 20 min | 30–50 µl | up to 200 ng | CS11040 |
| ChargeSwitch® gDNA 50 µl Sheep Blood Kit | 50 µl sheep blood | 5 min | 20–100 µl | up to 2 µg | CS11300<br>CS11300-10 |
| ChargeSwitch® gDNA Mini Tissue Kit | 0.5 cm tail tip or ~25 mg tissue (~10 mg for spleen) | 1.5–3 hr | 120–250 µl | up to 30 µg | CS11204 |
| ChargeSwitch® gDNA Micro Tissue Kit | mouse ear clips or 3–5 mg tissue | 1–2 hr | 40–150 µl | up to 5 µg | CS11203 |
| ChargeSwitch® Forensic DNA Kits | various forensic sample types* | 1 hr† | 20–150 µl | varies depending on the sample size and type | CS11200<br>CS11200-10 |
| ChargeSwitch® gDNA Buccal Cell Kits | human buccal cell swabs or pelleted cells from a mouth wash | 20 min | 40–150 µl | up to 6 µg | CS11021<br>CS11021-10 |
| ChargeSwitch® gDNA Normalized Buccal Cell Kits | human buccal cell swabs or pelleted cells from a mouth wash | 20 min | 150 µl | normalized yield of gDNA at 1–3 ng/µl in a total volume of 150 µl | CS11020<br>CS11020-10 |
| ChargeSwitch® gDNA Plant Kits | up to 100 mg of plant leaves, tissues, sprouts, shoots, or seeds | 5 min‡ | 40–150 µl | up to 7 µg | CS18000<br>CS18000-10 |
| ChargeSwitch® gDNA Mini Bacteria Kit | 0.1–0.5 ml of Gram-positive or Gram-negative bacterial culture or a colony picked from an agar plate | Gram-positive: 10 min; Gram-negative: 1–1.5 hr†† | 40–200 µl | up to 12 µg | CS11301 |

*The ChargeSwitch® Forensic DNA Kits were designed for DNA extraction from the following types of samples: dried blood spots on paper and clothing, hair follicles and hair shafts, cigarette butts, cigarette paper, envelopes, drinking vessel swabs, chewing gum, sperm head cells, vaginal epithelial cells, door handle swabs, strip removed cells (e.g., hats, coats, and gloves), "touch DNA" (e.g., tools, mobile phones, and microscopes), and dyed denim. †The length of the incubation can be shortened to 30 min if vortexing is performed during the incubation at 55°C. ‡This is the incubation time after homogenization of the sample. § If elution is desired, the DNA may be eluted with 100 µl of elution buffer per well. †† Bacterial samples must be treated with lysozyme for 10 min followed by lysis according to the table above.

# Applications in genotyping and identity testing

## Genotyping

### Allelic discrimination of human CYP2D6*4 genotypes

Using the ChargeSwitch® EasyPlex™ gDNA plates, three different genotypes were distinguished with higher confidence compared to samples where DNA was purified using a traditional silica-based purification kit (see Figure 6). Results suggested that DNA samples purified using silica-based spin columns may contain an inhibitor of fluorescence (or fluorescence transmission), even though they performed well in standard PCR.

## Quantitative PCR (SNP analysis)

ChargeSwitch® EasyPlex™ gDNA Kits are used to rapidly purify DNA from blood samples for SNP genotyping by qPCR. SYBR® Green qPCR was carried out directly in the purification plate to reveal the ABCA1 genotype of each sample. The melting curves obtained after qPCR show the presence of discrete, strong single peaks in homozygotes and double peaks in heterozygotes (Figure 7). The quality of the melting curve data is evidence of the purity of the gDNA starting material and of the accuracy of the genotyping results.

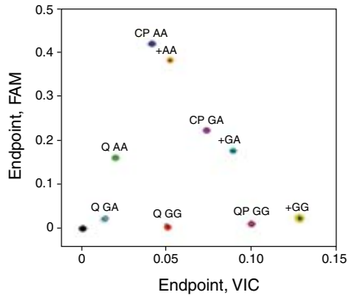



Figure 6—CYP2D6*4 TaqMan® end-point analysis of DNA from blood samples. The end-point fluorescence of each dye in each sample and control was plotted in the graph above. Genotypes are indicated above each point. Strong fluorescence of a single dye indicates a homozygous sample (either VIC or FAM; GG or AA, respectively), fluorescence of both dyes indicates a heterozygote (GA). The genotype of positive control DNA (50 ng) is indicated by the genotype preceded by a '+' ('+AA', '+GA', '+GG'). Figure shows a comparison between DNA samples prepared using ChargeSwitch® EasyPlex™ gDNA plates (each point is labeled with the genotype and the prefix 'CP') and 50 ng of DNA purified using a competitor's silica-based purification kit (labeled with genotype and prefix 'Q').

## Gender determination

Gender determination in forensic and databasing applications is enabled in a rapid, single-well protocol with the ChargeSwitch® EasyPlex™ gDNA Kits. Examples of particularly demanding applications include duplex and multiplex PCR. In the experiment shown in Figure 8, duplex PCR was performed to amplify gender-specific regions of the human X and Y chromosomes. The results show that 13 out of 36 samples were correctly identified as male.

## Purification of large volumes of blood

The GeneCatcher™ gDNA Blood Kits allow rapid and efficient extraction of genomic DNA (gDNA) from human blood, including archived or poorly stored blood samples (Figure 8). Genomic DNA is extracted from blood samples using the cost-effective, user-friendly magnetic bead–based GeneCatcher™ technology without the use of centrifugation.

Genotyping has become an essential application in clinical trials for pharmacogenomics studies. The emergence of pharmacogenomic centers of excellence has resulted in increasing needs for purification of high-quality genomic DNA from large volumes of blood. Since samples are collected and shipped worldwide, every sample may differ with regard to storage and shipping conditions. The GeneCatcher™ purification system (Figure 9) offers a method to purify gDNA from large volumes of blood that is robust and reproducible, ensuring complete sample recovery and integrity (Figure 10 and Table 2).

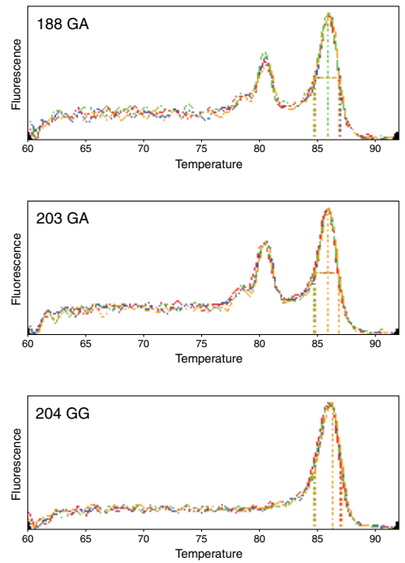



Figure 7—SYBR® Green I SNP analysis of qPCR products . A melting curve was produced for the products after PCR amplification directly in the plate for each blood sample as labeled. A single peak denotes a homozygotic sample ($T_m$ for A allele = 80°C, $T_m$ for G allele = 86°C), and two peaks indicate a heterozygote (GA). Genotype is indicated at the top left of each graph after the sample number. Analyses were carried out in quadruplicate on the DNA Engine Opticon® 2 System (MJ Research).

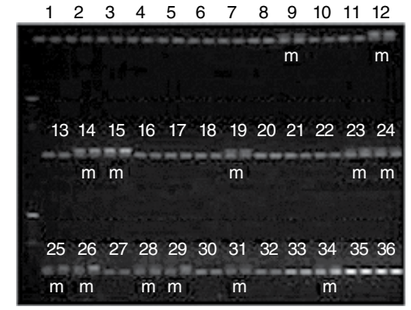



Figure 8—PCR of gDNA for gender determination. DNA was purified from 36 samples of human blood and subjected to PCR to determine gender. The gel shown here is an analysis of each PCR reaction. Blood samples from male donors (m) yielded two PCR products, whereas blood from female donors yielded a single product. Samples were run in duplicate to confirm the genotype. ('m', samples 9, 12, 14, 15, 19, 23, 24, 25, 26, 28, 29, 31, and 34).

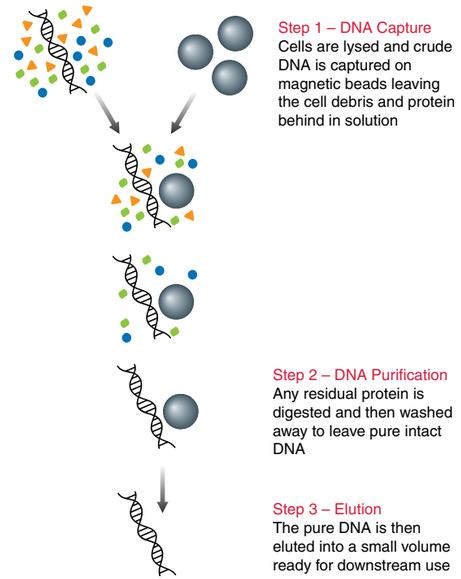



Figure 9—How GeneCatcher™ technology works. GeneCatcher™ techology's novel three-step cleanup enables scalable, single-tube purification of genomic DNA from large (up to 10 ml) blood samples.

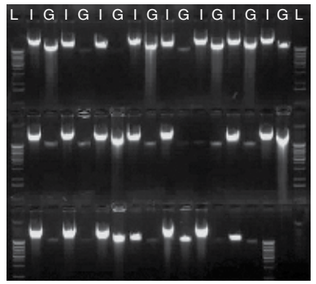



Figure 10—Purification of gDNA from archived whole blood samples using the GeneCatcher™ gDNA Blood Kit. An 0.8% agarose gel used to evaluate gDNA extractions from archived whole blood samples (blood samples frozen >8 years). Blood samples were split into 2 equal aliquots, and gDNA was extracted using the GeneCatcher™ gDNA Blood Kit and a kit from competitor G. GeneCatcher™ Kit extractions employ magnetic beads, while competitor G's kit uses a form of the traditional lysis and DNA precipitation method that has been shown to co-purify agents that are inhibitory to downstream applications. **I** = Invitrogen GeneCatcher™ extractions; **G** = competitor G extractions; **L** = 1 Kb DNA Extension Ladder (Invitrogen), largest band 40 Kb.

Table 2—Comparison of gDNA extractions from fresh and frozen* whole blood using the GeneCatcher™ gDNA Blood Kit.

| Storage conditions | NBS batch | Sample ID | Purity ($A_{260}/A_{280}$ ratio) | Replicate yield ($A_{260}$) | Average yield (µg) | Frozen yield as % fresh |
|---|---|---|---|---|---|---|
| Fresh | 258 | A | 1.87 | 330 | 324 | 105 |
| | | B | 1.88 | 327 | | |
| | | C | 1.88 | 314 | | |
| Frozen | 258 | A | 1.85 | 350 | 340 | |
| | | B | 1.84 | 293 | | |
| | | C | 1.85 | 376 | | |
| Fresh | 259 | A | 1.88 | 244 | 245 | 111 |
| | | B | 1.87 | 241 | | |
| | | C | 1.87 | 249 | | |
| Frozen | 259 | A | 1.84 | 268 | 272 | |
| | | B | 1.85 | 261 | | |
| | | C | 1.85 | 288 | | |
| Fresh | 260 | A | 1.85 | 311 | 308 | 101 |
| | | B | 1.86 | 301 | | |
| | | C | 1.82 | 313 | | |
| Frozen | 260 | A | 1.84 | 299 | 311 | |
| | | B | 1.84 | 321 | | |
| | | C | 1.85 | 312 | | |
| Fresh | 261 | A | 1.81 | 179 | 208 | 70 |
| | | B | 1.84 | 229 | | |
| | | C | 1.78 | 217 | | |
| Frozen | 261 | A | 1.80 | 143 | 146 | |
| | | B | 1.85 | 150 | | |
| | | C | 1.84 | 146 | | |

* Blood from four donors was split into two equal portions. One portion was stored at 4°C for up to 3 days, and the other portion was frozen at –20°C for 1 month. Samples were removed from storage for processing and split into three aliquots (A, B, and C). Genomic DNA was purified from each aliquot using the GeneCatcher™ gDNA Blood Kit. Yield and purity measurements were performed from each sample using $A_{260}/A_{280}$ readings. In general, yields were consistent between replicates of the same sample and were independent of storage conditions.



## Plant genotyping

New genetic manipulation methods have enabled the insertion of specific traits into important crops, for example to transfer insect resistance or herbicide tolerance from other crops or organisms. Members of the plant research community are finding that the ChargeSwitch® gDNA Plant Kit gives outstanding yields of highly purified gDNA for subsequent genotyping, even from tough matrices like seeds (Figure 11). PCR inhibitors are abundant in plant samples, especially in starchy samples like seeds; however, when PCR was performed using a selection of gDNA sample types similar to those shown in Figure 11 (cotton, sunflower, canola, and corn seeds), both the *cox* and *trnL* genes were successfully amplified (Figure 12).

## End-point PCR on degraded DNA from old bones using the ChargeSwitch® gDNA Plant Kit

The flexibility of the ChargeSwitch® chemistry is illustrated in one application where the plant kit has been modified to efficiently extract DNA from both new and old bone materials. These protocols are especially relevant for anthropological and human identity studies. The ability to isolate and purify DNA of smaller sizes is of critical importance when working with degraded samples (Figure 13).

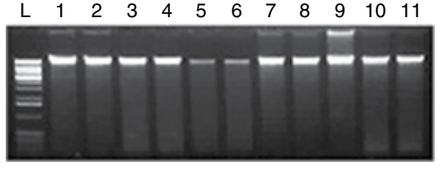



Figure 11—High-quality DNA extracted from a variety of seed types. DNA extracted from four different seed types (cotton, sunflower, popping corn, and canola) using the ChargeSwitch® gDNA Plant Kit. Results visualized on 0.8% agarose gel. **L:** 1 Kb DNA Extension Ladder; **Lanes 1, 2 :** cotton; **Lanes 3, 4:** sunflower (Galaxy); **Lanes 5, 6:** sunflower (Henry Wilde); **Lanes 7, 8, 9:** canola (10 seeds, 50 mg); **Lanes 10, 11:** popping corn.

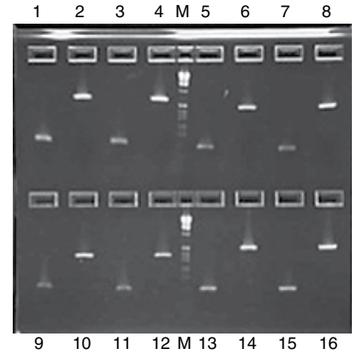



Figure 12— Successful PCR amplification of gDNA isolated using the ChargeSwitch® gDNA Plant Kit. 5 µl from each purified gDNA sample was amplified using PCR and the primers for the *cox* gene or for the *trnL* gene. The reaction volume was 50 µl and Invitrogen's Platinum® PCR SuperMix was employed. **M:** 1 Kb DNA Ladder; **Lanes 1, 3:** amplification of the *cox* gene from cotton seed; **Lanes 2, 4:** amplification of the *trnL* gene from cotton; **Lanes 5, 7:** amplification of the *cox* gene from sunflower (Pastiche); **Lanes 6, 8:** amplification of the *trnL* gene from sunflower (Pastiche); **Lanes 9, 11:** amplification of the *cox* gene from canola; **Lanes 10, 12:** amplification of the *trnL* gene from canola; **Lanes 13, 15:** amplification of the *cox* gene from corn; **Lanes 14, 16:** amplification of the *trnL* gene from corn.

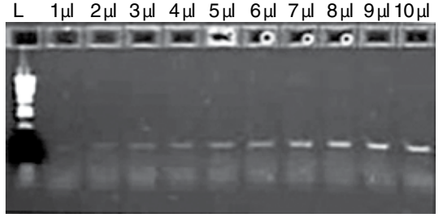



Figure 13—DNA efficiently purified from old bone. The GAPDH gene was amplified from increasing amounts of template DNA from purified old bones (1–10 µl from left to right). A corresponding increase can be seen in the single PCR product. These data show that PCR inhibitors were not copurified with the DNA.

## Forensic casework identification

Forensic applications involve extraction of DNA from samples as diverse as hair and nails to cigarettes and gum. A critical technique in the area of forensic science is the isolation and extraction of gDNA left by a perpetrator on a victim or on objects at a crime scene. Using hydrosoluble tape to capture this evidence, gDNA can be extracted and analyzed for DNA profiling and databasing of crime scene samples (Figure 14). The ChargeSwitch® Forensic DNA Purification Kit affords the highest sensitivity and robustness. This kit is designed to accommodate the broad variety of forensic crime scene sample types required for STR profiling.

## Quant-iT™ dsDNA Assay Kits for sensitive and selective DNA quantitation

If your starting material is scarce or if the success of your downstream application requires absolute confidence in the amount of DNA used (i.e., SNP and STR analyses), fluorescence-based Quant-iT™ dsDNA Assay Kits deliver the results you need in an easy-to-use format. The kit provides concentrated assay reagent, dilution buffer, and prediluted DNA standards. Simply dilute the reagent 1:200, load 200 µl into the wells of a microplate, add 1–20 µl sample volumes, mix, then read the fluorescence. The assay is highly selective for double-stranded DNA over RNA and tolerates common contaminants such as free nucleotides, salts, solvents, detergents, and protein. The assay is performed at room temperature, and the signal is stable for 3 hr. For samples in the range of 0.2–100 ng, choose the Quant-iT™ dsDNA High-Sensitivity Assay Kit (Figure 15); for samples in the range of 2–1,000 ng, choose the Quant-iT™ dsDNA Broad-Range Assay Kit (Figure 16).

## Easy-to-use qPCR SuperMixes for SNP genotyping

Platinum® qPCR SuperMix-UDG for SNP Genotyping is a ready-to-use reaction mix for the amplification and identification of single nucleotide polymorphisms (SNPs) in genomic DNA using PCR-based fluorescent SNP genotyping technologies. This supermix is specifically formulated for fluorescent discrimination of alleles by either qPCR or end-point PCR followed by fluorescent plate reader analysis. Special additives provide enhanced fluorescent signals for better discrimination of alleles and excellent separation with minimal scattering between replicate samples (Figure 17). The supermix format and integrated UDG carryover prevention make this reagent well suited for high-throughput applications.

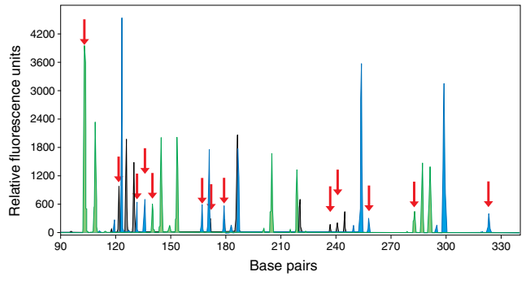



Figure 14—Profile of DNA from hydrosoluble tape. Volunteers performed hand-to-arm contact for 10 sec followed by collection of the mixed-cell population with hydrosoluble tape. The tape was incubated in tape dissolution lysis buffer for 10 min before the extraction using the ChargeSwitch® Forensic DNA Purification Kit. When the DNA was analyzed for donor (hand) and recipient (arm) DNA, the quantity of gDNA extracted was of a yield and purity sufficient to allow accurate genotyping of both sources of the DNA. Even though the gDNA from the donor is of lower abundance than from the recipient, the identification alleles from the hand were amplified and detected. Donor alleles (from the hand) are indicated by arrows. Data abstracted from Petricevic, S., Pene, L., Reverchon, L., McKenzie, K. "Recovery of Trace DNA Using Hydrosoluble Tape and the Invitrogen ChargeSwitch® Forensic DNA Purification Kit." Poster presented at the Fourth European–American School in Forensic Genetics and Mayo Clinic Course in Advanced Molecular Medicine, Dubrovnik, Croatia, September 5–9, 2005.

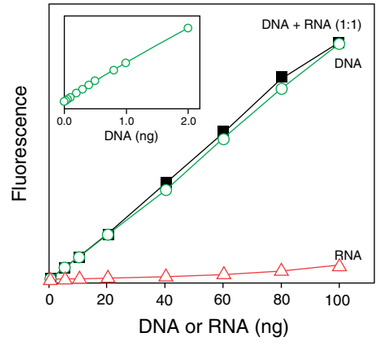



Figure 15—DNA selectivity and sensitivity of the Quant-iT™ dsDNA High-Sensitivity Assay Kit. Triplicate 10 µl samples of λ DNA (open circle), *E. coli* rRNA (open triangle), or a 1:1 mixture of DNA and RNA (filled square) were assayed in the Quant-iT™ dsDNA high-sensitivity assay. Fluorescence was measured at 485/530 nm and plotted versus the mass of nucleic acid for the DNA alone or RNA alone, or versus the mass of the DNA component in the 1:1 mixture. The variation (CV) of replicate DNA determinations was ≤2%. The inset, a separate experiment with octuplicate determinations, shows the extreme sensitivity of the assay for DNA. Background fluorescence has not been subtracted.

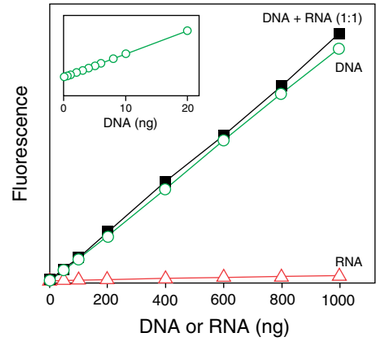
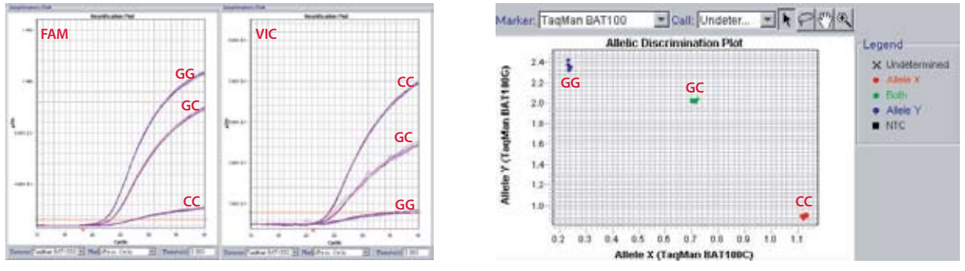



Figure 16—DNA selectivity and sensitivity of the Quant-iT™ dsDNA Broad-Range Assay Kit. Triplicate 10 µl samples of λ DNA (open circle), *E. coli* rRNA (open triangle), or a 1:1 mixture of DNA and RNA (filled square) were assayed in the Quant-iT™ dsDNA broad-range assay. Fluorescence was measured at 485/530 nm and plotted versus the mass of nucleic acid for the DNA alone or RNA alone, or versus the mass of the DNA component in the 1:1 mixture. The variation (CV) of replicate DNA determinations was ≤3%. The inset, a separate experiment with octuplicate determinations, shows the sensitivity of the assay for DNA. Background fluorescence has not been subtracted.

A. Invitrogen




B. ABI

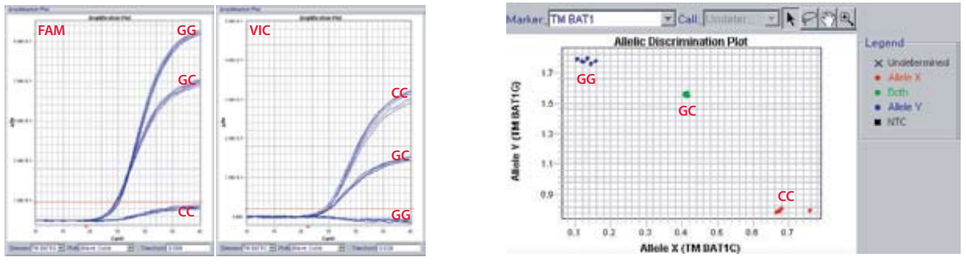



Figure 17—Platinum® qPCR SuperMix-UDG for SNP Genotyping vs. ABI Universal PCR Master Mix. **A.** qPCR genotyping results using TaqMan® SNP Genotyping Assay for BAT 1 and Invitrogen's Platinum® qPCR SuperMix-UDG for SNP Genotyping. **B.** qPCR genotyping results using TaqMan® SNP Genotyping Assay for BAT 1 and ABI's Universal Master Mix. Each assay was run according to the reagent manufacturer's recommended protocol on an ABI PRISM® 7900HT.

# Protocols

This section contains brief protocols for the products featured in this publication. For detailed protocols, refer to the product manuals at www.invitrogen.com/gdna.

## Protocol for ChargeSwitch® EasyPlex™ gDNA Kit

**For ultrafast, amplification-ready gDNA from whole blood or cells**

1. Dispense 100 µl of Plate Binding and Lysis Buffer into each well of the ChargeSwitch® EasyPlex™ gDNA plates.
2. Add up to 10 µl of whole blood sample.
3. Tip mix.
4. Incubate for 30 min at room temperature.
5. Aspirate liquid.
6. Add 120 µl of Wash Buffer (W10).
7. Aspirate liquid.
8. Add 120 µl of Wash Buffer (W12).
9. Aspirate liquid.
10. Proceed to enzymatic reaction.

## Protocol for high-efficiency purification from whole blood (ChargeSwitch® gDNA 50–100 µl Blood Kit)

**For purification of up to 3 µg from up to 100 µl**

### Preparing the Sample

1. Prepare Lysis Mix 1 ml of Lysis Buffer with 10 µl of Proteinase K per sample).
2. Add 1 ml of Lysis Mix to the blood, and gently pipet up and down 5 times.
3. Incubate at room temperature for 10 min. During incubation, proceed to Binding the DNA.

### Binding the DNA

4. Prepare Purification Mix by mixing 40 µl of ChargeSwitch® Magnetic Beads with 200 µl of Purification Buffer per sample.
5. Add 240 µl of Purification Mix to each sample, and gently pipet up and down 5 times.
6. Incubate at room temperature for 1 min, then place the plate in the magnetic separator for 1 min.
7. Remove and discard the supernatant, then remove tube or plate from the magnet.

### Washing the Beads

8. Add 1 ml of Lysis Buffer (without Proteinase K) per sample and gently pipet up and down 3 times.
9. Add 50 µl of Purification Buffer per well, and gently pipet up and down 3 times.
10. Incubate at room temperature for 1 min, then place the plate or tube in the magnetic separator for 1 min.
11. Remove and discard the supernatant.
12. With the sample still in the magnetic separator, add 1 ml of Wash Buffer to each well, and gently pipet the buffer up and down 1–2 times.
13. If necessary, allow the beads to separate in the magnetic separator for 1 min.
14. Remove and discard the supernatant, then remove the sample from the magnet.

### Eluting the DNA

15. Add 150 µl of Elution Buffer to each sample, and gently pipet up and down 10 times or until the beads are completely resuspended.
16. Incubate at room temperature for 1 min.
17. Place the tube in the magnetic separator for 3 min, until the beads form a tight pellet.
18. Transfer the eluate containing the purified DNA to a new tube or plate.

## Protocol for GeneCatcher™ gDNA 3–10 ml Blood Kit

**For purification of up to 600 µg of genomic DNA from 3–10 ml of human blood**

**Important Note:** The volumes of Lysis Buffer, GeneCatcher™ Magnetic Beads, Protease Buffer, Protease, and 100% IPA in the following protocol are for 10 ml of blood.

### Before Starting

1. Set water bath at 65°C.
2. Vortex the GeneCatcher™ Magnetic Beads to resuspend.

### Binding the DNA

3. For 10 ml of blood, add 150 µl of GeneCatcher™ Magnetic Beads to a 50 ml tube.
4. Add 30 ml of Lysis Buffer and mix.
5. Add 10 ml of blood and invert to mix.
6. Incubate at room temperature for 5 min.
7. Place the tube on a 50 ml tube magnetic separator for 3 min.
8. Remove and discard the supernatant.
9. Add 5 ml of Lysis Buffer and mix.
10. Incubate at room temperature for 30 sec, then separate for 20 sec on the magnetic separator.
11. Remove and discard the supernatant.

### Purifying the DNA

12. Add 5 ml of Protease Buffer and 40 µl of Protease to the tube.
13. Cap the tube and vortex to disperse the pellet.
14. Incubate at 65°C for 10 min, and vortex if necessary to resuspend.
15. Allow the tube to cool to room temperature, then add 5 ml of 100% isopropyl alcohol (IPA).
16. Invert the tube to mix until a visible aggregate has formed, then place on the magnetic separator for 30 sec.
17. Remove and discard the supernatant.
18. Add 3 ml of 50% (v/v) aqueous IPA, and mix.
19. Place the tube on the magnet for 20 sec, then remove the liquid and discard.
20. Leave the tube on the magnet for 1 additional min, then remove and discard any residual liquid.

### Washing the Beads

21. Add 250 µl of Wash Buffer to the tube on the magnet, and incubate for 1 min.
22. Remove and discard the supernatant.
23. Repeat wash steps 21–22 one more time, then remove the tube from the magnet.

### Eluting the DNA

24. Add 1 ml of Elution Buffer. Swirl the tube gently to dislodge the pellet from the tube wall.
25. Incubate at 65°C for 1 hr.
26. Swirl the tube again gently to completely disperse the pellet (may require overnight incubation).
27. Place the tube on the magnetic separator until the supernatant is totally clear and colorless.
28. Remove the eluate containing the purified DNA to a clean tube.

## Protocol for serum (ChargeSwitch® gDNA 1 ml Serum Kit)

**For purification of up to 200 ng of genomic DNA from 0.2–1 ml of fresh or frozen human serum (volumes are for 1 ml of serum)**

### Preparing the Sample

1. Vortex the ChargeSwitch® Magnetic Beads to resuspend.
2. Add 1 ml of serum to a 2 ml microcentrifuge tube.
3. Add 700 µl of Lysis Buffer and 30 µl of Proteinase K.
4. Optional: Add 5 µl of RNase A or RNase A/T1 cocktail.
5. Mix by pipetting and incubate at room temperature for 20 min.

### Binding the DNA

6. Add 250 µl of Purification Buffer and 30 µl of ChargeSwitch® Magnetic Beads.
7. Incubate at room temperature for 2 min, then separate on the MagnaRack™ magnetic separator for 3 min.
8. Remove and discard the supernatant.

### Washing the Beads

9. Add 1 ml of Wash Buffer.
10. Place the tube in the MagnaRack™ magnetic separator for 2 min.
11. Remove and discard the supernatant.
12. Repeat wash steps 9–11 one more time.

### Eluting the DNA

13. Add 50 µl of Elution Buffer and mix .
14. Incubate at room temperature for 2 min.
15. Place the tube in the MagnaRack™ magnetic separator for 1 min.
16. Transfer the eluate containing the purified DNA to a clean tube.

## Protocol for ChargeSwitch® gDNA Micro Tissue Kit and Mini Kit

**For purification of up to 5 µg of genomic DNA from micro-dissected samples, or up to 30 µg from 25 mg of tissue (instructions specific for the Mini Tissue Kit in red)**

### Before Starting

1. Set water bath at 55°C.
2. For Mini Tissue Kit, proceed to step 3. For Micro Tissue Kit, prepare Lysis Mix: 1 ml Lysis Buffer and 10 µl Proteinase K per sample.
3. For 20–25 mg tissue sample: place sample in a tube, add 1 ml of Lysis Buffer, and homogenize. Add 20 µl Proteinase K. Proceed to step 6 below.

### Preparing the Tissue Lysate

4. Microdissect 3–5 mg tissue sample.
5. Add 1 ml Lysis Mix, prepared in step 2.
6. Incubate at 55°C overnight or 1–2 hr (1.5–3 hr or until digested) with vortexing.
7. Remove from incubation and add 5 µl (10 µl) of RNase A.
8. Pipet gently up and down until homogenous.
9. Incubate at room temperature for 5 min.

### Binding the DNA

10. Vortex the ChargeSwitch® Magnetic Beads to resuspend.
11. Add 200 µl (100 µl) of Purification Buffer. (For Mini Tissue Kit protocol, add magnetic beads first, then Purification Buffer.)
12. Add 40 µl (120 µl) of ChargeSwitch® Magnetic Beads.
13. Incubate at room temperature for 1 min.
14. Place the tube in the MagnaRack™ magnetic separator for 1 min (2 min).
15. Carefully remove supernatant and discard.

### Washing the Beads

16. Remove the tube from the MagnaRack™ magnetic separator.
17. Add 1 ml of Wash Buffer and mix.
18. Place the tube in the MagnaRack™ magnetic separator for 1 min.
19. Remove the supernatant with a pipette and discard.
20. Repeat steps 16–19.

### Eluting the DNA

21. Remove the tube from the MagnaRack™ magnetic separator, and add 150 µl (250 µl) of Elution Buffer.
22. Pipet gently up and down 10 times to resuspend beads.
23. Incubate for 5 min at room temperature (55°C).
24. Place the tube in the MagnaRack™ magnetic separator for 1 min (2 min).
25. Remove the eluate containing purified DNA.

## Protocol for purification of genomic DNA from forensic samples (ChargeSwitch® Forensic DNA Purification Kits)

### Before Starting

1. Set a water bath at 55°C.
2. For each sample, mix 1 ml of Lysis Buffer and 10 µl of Proteinase K to prepare the Lysis Mix.

### Preparing the Lysate

3. Add 1 ml of Lysis Mix to the tube.
4. Add the forensic sample to the tube, making sure that the sample is completely immersed in the Lysis Mix.
5. Vortex or invert the tube for 10–15 sec to mix.
6. Incubate the sample for 1 hr at 55°C until lysis is complete.

**Note:** The length of the incubation step can be shortened to 30 min by vortexing or inverting the tube during this period.

7. Remove the sample with disposable tweezers or transfer the lysate (supernatant) to a new sterile microcentrifuge tube.

### Binding the DNA

8. Add 200 µl of Purification Buffer to the lysate.
9. Vortex the tube containing the ChargeSwitch® Magnetic Beads.
10. Add 20 µl of ChargeSwitch® Magnetic Beads and mix.
11. Incubate at room temperature for 1–5 min
12. Place the sample in the MagnaRack™ magnetic separator for 1 min.
13. Remove the supernatant and discard.

### Washing the Beads

14. Remove the tube from the MagnaRack™ magnetic separator.
15. Add 500 µl of Wash Buffer.
16. Place the sample in the MagnaRack™ magnetic separator for 1 min.
17. Remove the supernatant and discard.
18. Repeat Steps 14–17.

### Eluting the DNA

19. Remove the tube from the MagnaRack™ magnetic separator.
20. Add 150 µl of ChargeSwitch® Elution Buffer (or TE Buffer, pH 8.5).
21. Incubate at room temperature for 1–5 min.
22. Pipet up and down gently 10 times to resuspend the magnetic beads.
23. Place the sample in the MagnaRack™ magnetic separator for 1 min.
24. Remove the eluate containing purified DNA.

**Note:** For DNA sampled using hydrosoluble tape, the Invitrogen ChargeSwitch® Forensic DNA Purification Kit protocol is modified with a step to dissolve the tape in lysis buffer for 10 min at 85°C. Two wash steps are performed following the extraction step, and samples are eluted in 50 µl of buffer buffer.

## Protocol for purification of genomic DNA from human buccal swabs (ChargeSwitch® gDNA Buccal Cell Kits)

**For purification of up to 6 µg of DNA from 1 swab**

### Before Starting

1. Set a water bath at 37°C.
2. Prepare a Lysis Mix: mix 1 ml of ChargeSwitch® Lysis Buffer and 10 µl of Proteinase K per sample.
3. Vortex the tube containing the ChargeSwitch® Magnetic Beads.
4. Prepare a Purification Mix: mix 40 µl of ChargeSwitch® Magnetic Beads and 100 µl of ChargeSwitch® Purification Buffer per sample.

### Preparing the Lysate

5. Transfer the human buccal cell sample to a sterile microcentrifuge tube.
6. Add 1 ml of Lysis Mix to the tube, making sure that the sample is completely immersed in the Lysis Mix.
7. Incubate the sample at 37°C for 20 min.

### Binding the DNA

8. Transfer the supernatant into a new, sterile microcentrifuge tube.
9. Gently mix the Purification Mix containing the ChargeSwitch® Magnetic Beads.
10. Add 140 µl of Purification Mix to the sample and mix.
11. Incubate at room temperature for 1 min.
12. Place the sample in the MagnaRack™ magnetic separator for 1 min.
13. Remove the supernatant and discard.

### Washing the Beads

14. Add 1 ml of Wash Buffer to the sample.
15. Leave the sample in the MagnaRack™ magnetic separator for 1 min.
16. Remove the supernatant and discard.
17. Repeat Steps 14–16.

### Eluting the DNA

18. Remove the tube containing the pelleted magnetic beads from the MagnaRack™ magnetic separator.
19. Add 150 µl of Elution Buffer (or TE Buffer, pH 8.5).
20. Incubate at room temperature for 1 min.
21. Place the sample in the MagnaRack™ magnetic separator for 1 min.
22. Remove the eluate containing the DNA to a sterile microcentrifuge tube.

## Protocol for plant tissue and seeds (ChargeSwitch® gDNA Plant Kit)

**For purification of up to 7 µg of DNA from 50–100 mg of plant material**

### Preparing Plant Lysate

1. Chill the Precipitation Buffer on ice.
2. For hard plant tissue, freeze the tissue in liquid nitrogen and grind frozen tissue to powder using mortar and pestle. For soft, nonfibrous plant tissue, cut the tissue into small pieces.
3. Add 1 ml ChargeSwitch® Lysis Buffer and 2 µl RNase A to the tissue.
4. Prepare lysate by homogenizing the pieces of soft tissue with a tissue homogenizer or grinder, or by vortexing the ground tissue/lyophilized sample until the sample is completely resuspended.
5. Add 100 µl 10% SDS to 1 ml plant lysate.
6. Incubate at room temperature for 5 min.
7. Add 400 µl Precipitation Buffer to the lysate. Mix until a precipitate forms.
8. Centrifuge at maximum speed for 5 min at room temperature to produce a clear lysate.
9. Transfer the clear lysate to a new, sterile 1.5 ml microcentrifuge tube for manual purification or to a deep-well 96 × 2 ml plate.

### Binding the DNA

10. Thoroughly vortex the tube containing the ChargeSwitch® Magnetic Beads.
11. Add 100 µl ChargeSwitch® 10% Detergent to the ~1.2 ml lysate.
12. Add 40 µl resuspended ChargeSwitch® Magnetic Beads.
13. Mix gently by pipetting up and down 5 times.
14. Incubate at room temperature for 1 min.
15. Place tubes on the MagnaRack™ magnetic separator until the beads have formed a tight pellet.
16. Remove and discard the supernatant.

### Washing the Beads

17. Remove tubes from the magnet.
18. Add 1 ml of Wash Buffer and mix.
19. Place tubes on the magnet until the beads have formed a tight pellet.
20. Remove and discard the supernatant.
21. Repeat steps 17–20.

### Eluting the DNA

22. Remove the tube containing the pelleted magnetic beads from the magnet.
23. Add 150 µl of Elution Buffer.
24. Pipet up and down gently 15–30 times.
25. Incubate at room temperature for 1 min.
26. Place tubes on the magnet until the beads have formed a tight pellet.
27. Transfer the eluate containing the DNA to a sterile microcentrifuge tube.

## Protocol for the extraction of DNA from old and new bone (ChargeSwitch® gDNA Plant Kit)

**The purification of genomic DNA from both fresh and old bone has been tested with the following protocol. The extraction follows the protocol for the ChargeSwitch® gDNA Plant Kit.**

### Obtaining the Sample

The bone was washed thoroughly and surface-sterilized using 1% Virkon. Approximately 100 mg of bone was ground using a 1/8th inch drill bit on slow drill speed to avoid heating the bone. The drill bit was passed through the bone material into the marrow cavity and into the bone at the other side. The bit was then extracted and any material removed from the bit head.

### Preparing the Sample

The gDNA purification protocol below employs an overnight incubation at 37°C in 1 ml plant Lysis Buffer containing SDS, with no further preparation of the bone material. If desired the following modifications to the protocol below are also available:

→ The bone can be further homogenized using pestle and mortar

→ 30 µl Proteinase K (100 mg/ml) can be added to the Lysis reaction

→ If overnight incubations are not desirable, digestion can be performed at 65°C for 1 to 3 hr

1. Incubate ground bone material overnight at 37°C in 1 ml plant Lysis Buffer and 100 µl 10% SDS.
2. Cool to room temperature and add 5 µl of RNase A. Incubate at room temperature for 1 min.
3. Centrifuge at maximum speed for 5 min to remove the bone and tissue debris.
4. Transfer the cleared lysate to a fresh tube.
5. Add 400 µl of prechilled Precipitation Buffer to the lysate and mix by inversion (the precipitation reaction works better at lower temperatures).
6. Centrifuge for 5 min at maximum speed to precipitate the SDS/proteins and any remaining cell debris.
7. Transfer the cleared lysate to a fresh tube.

### Binding the DNA

8. Add 100 µl ChargeSwitch® 10% Detergent to each sample.
9. Resuspend ChargeSwitch® Magnetic Beads by vortexing and add 20 µl of beads to each sample.
10. Tip mix 5 times to ensure that the beads are evenly suspended, and incubate at room temperature for 1 min. At this stage the gDNA is bound to the beads, and they may clump if the DNA is of high molecular weight.

**Note:** To expedite processing of multiple samples, prepare a bulk mixture containing 20 µl of ChargeSwitch® Magnetic Beads and 100 µl of 10% detergent per sample, and add 120 µl of this mixture to each bone sample instead of adding detergent and ChargeSwitch® Magnetic Beads as separate steps (steps 8 and 9). Ensure that the ChargeSwitch® Magnetic Beads are fully resuspended before use.

11. Place the tube in the MagnaRack™ magnetic separator for 1 min or until the beads form a tight pellet.
12. Remove and discard the supernatant.

### Washing the Beads

13. Remove the tube from the MagnaRack™ magnetic separator and fully resuspend the bead pellet in 1 ml of Wash Buffer and mix.
14. Place in the MagnaRack™ magnetic separator for 1 min or until a tight pellet forms.
15. Remove and discard the supernatant.
16. Repeat steps 13–15 once.

### Eluting the DNA

17. Remove the tube from the MagnaRack™ magnetic separator and resuspend the bead pellet in 50–100 µl of Elution Buffer.
18. Incubate at room temperature for 1 min.

**Optional:** Longer incubation times can increase the final yield of DNA. Heated elutions can also increase the yield if the DNA is of high molecular weight.

19. Place in the MagnaRack™ magnetic separator for 1 min or until the beads form a tight pellet.
20. Transfer the eluate containing the purified gDNA to a fresh tube.

Following overnight digestion at 37°C the gDNA yield obtained from 100 mg of fresh bone material (including marrow tissue) was between 1 and 2 µg, the $A_{260}/A_{280}$ ratio was between 1.6 and 1.8, and the purified DNA was successfully used in downstream PCR reactions.

## Quant-iT™ dsDNA High-Sensitivity Assay Kit

### For quantitation of dsDNA in the range of 0.2–100 ng (equivalent to sample concentrations of 0.01–100 µg/ml)

During all steps, protect the Quant-iT™ dsDNA HS Reagent concentrate and the working solution from light as much as possible.

1. Remove the kit from storage and allow the components to equilibrate to room temperature.
2. Make a working solution by diluting Quant-iT™ dsDNA HS Reagent 1:200 in Quant-iT™ dsDNA HS Buffer. For example, for ~100 assays put 100 µl of Quant-iT™ dsDNA HS Reagent (Component A) and 20 ml of Quant-iT™ dsDNA HS Buffer (Component B) in a disposable plastic container and mix well. Do not use glass containers.
3. Dispense 200 µl of the working solution into each microplate well. Diluted Quant-iT™ dsDNA HS Reagent is stable for at least 3 hr at room temperature, protected from light.
4. Add 10 µl of each λ DNA standard (Component C) to separate wells, and mix well. Take care not to introduce nucleases into the tubes of DNA standard as you remove aliquots for the assay. Duplicates or triplicates of the standards are recommended.
5. Add 1–20 µl of each unknown DNA sample to separate wells, and mix well. Duplicates or triplicates of the unknown samples are recommended. Some contaminating substances may interfere with the assay; see the Instruction Manual at www.invitrogen.com for details.
6. Measure the fluorescence using a microplate reader (excitation/emission maxima are ~502/523 nm). Standard fluorescein wavelengths (excitation/emission at ~480/530 nm) are appropriate for this dye. The fluorescence signal is stable for 3 hr at room temperature.
7. Use a standard curve to determine the DNA amounts. For the λ DNA standards, plot amount vs. fluorescence, and fit a straight line to the data points.

## Quant-iT™ dsDNA Broad-Range Assay Kit

### For quantitation of dsDNA in the range of 2–1000 ng (equivalent to sample concentrations of 0.1–1,000 µg/ml)

During all steps, protect the Quant-iT™ dsDNA BR Reagent concentrate and the working solution from light as much as possible.

→ Remove the kit from storage and allow the components to equilibrate to room temperature.

→ Make a working solution by diluting Quant-iT™ dsDNA BR Reagent 1:200 in Quant-iT™ dsDNA BR Buffer. For example, for ~100 assays put 100 µl of Quant-iT™ dsDNA BR Reagent (Component A) and 20 ml of Quant-iT™ dsDNA BR Buffer (Component B) in a disposable plastic container and mix well. Do not use glass containers.

→ Dispense 200 µl of the working solution into each microplate well. Diluted Quant-iT™ dsDNA BR Reagent is stable for at least 3 hr at room temperature, protected from light.

→ Add 10 µl of each λ DNA standard (Component C) to separate wells, and mix well. Take care not to introduce nucleases into the tubes of DNA standard as you remove aliquots for the assay. Duplicates or triplicates of the standards are recommended.

→ Add 1–20 µl of each unknown DNA sample to separate wells, and mix well. Duplicates or triplicates of the unknown samples are recommended. Some contaminating substances may interfere with the assay; see the Instruction Manual at www.invitrogen.com for details.

→ Measure the fluorescence using a microplate reader (excitation/emission maxima are ~510/527 nm). Standard fluorescein wavelengths (excitation/emission at ~480/530 nm) are appropriate for this dye. The fluorescence signal is stable for 3 hr at room temperature.

→ Use a standard curve to determine the DNA amounts. For the λ DNA standards, plot amount vs. fluorescence, and fit a straight line to the data points.

## Ordering information

| Product | Cat. no. |
|---|---|
| **ChargeSwitch® gDNA Blood and Serum Kits** | |
| ChargeSwitch® gDNA 50–100 µl Blood Kit, 50 preps | CS11000 |
| ChargeSwitch® gDNA 50–100 µl Blood Kit, 960 preps | CS11000-10 |
| ChargeSwitch® gDNA 50 µl Sheep Blood Kit, 50 preps | CS11300 |
| ChargeSwitch® gDNA 50 µl Sheep Blood Kit, 960 preps | CS11300-10 |
| ChargeSwitch® gDNA 1 ml Serum Kit, 50 preps | CS11040 |
| ChargeSwitch® Direct 96 gDNA Kit, one 96-well plate | CS11205 |
| ChargeSwitch® Direct 96 gDNA Kit, ten 96-well plates | CS11206 |
| ChargeSwitch® Direct 8-well gDNA Kit, 96 preps | CS11209 |
| ChargeSwitch® EasyPlex™ gDNA Kit, one 96-well plate | CS11207 |
| ChargeSwitch® EasyPlex™ gDNA Kit, ten 96-well plates | CS11208 |
| ChargeSwitch EasyPlex 8-well gDNA Kit, 96 preps, | CS11211 |
| **GeneCatcher™ gDNA Blood Kits** | |
| GeneCatcher™ gDNA Blood Kit, 0.3–1 ml | CS21101 |
| GeneCatcher™ gDNA Blood Kit, 3–10 ml | CS21110 |
| **ChargeSwitch® gDNA Tissue Kits** | |
| ChargeSwitch® gDNA Mini Tissue Kit, 25 preps | CS11204 |
| ChargeSwitch® gDNA Micro Tissue Kit, 50 preps | CS11203 |
| **ChargeSwitch® Forensic and gDNA Buccal Cell Kits** | |
| ChargeSwitch® Forensic DNA Purification Kit, 100 preps | CS11200 |
| ChargeSwitch® Forensic DNA Purification Kit, 960 preps | CS11200-10 |
| ChargeSwitch® gDNA Buccal Cell Kit, 50 preps | CS11021 |
| ChargeSwitch® gDNA Buccal Cell Kit, 960 preps | CS11021-10 |
| ChargeSwitch® gDNA Normalized Buccal Cell Kit, 50 preps | CS11020 |
| ChargeSwitch® gDNA Normalized Buccal Cell Kit, 960 preps | CS11020-10 |

| Product | Cat. no. |
|---|---|
| **ChargeSwitch® gDNA Plant Kits** | |
| ChargeSwitch® gDNA Plant Kit, 96 preps | CS18000 |
| ChargeSwitch® gDNA Plant Kit, 960 preps | CS18000-10 |
| **ChargeSwitch® gDNA Mini Bacteria Kit** | |
| ChargeSwitch® gDNA Mini Bacteria Kit, 50 preps | CS11301 |
| **Magnetic separators** | |
| MagnaRack™ Magnetic Separator | CS15000 |
| 24-well Magnetic Separator | CS15024 |
| 50 ml tube Magnetic Separator | CS15050 |
| 96-well Magnetic Separator | CS15096 |
| 96 Deep Well Blocks | CS15196 |
| 24 Deep Well RB Blocks | CS15124 |
| Lids for 24 Deep Well RB blocks | CS15125 |
| **Nucleic acid quantitation** | |
| Qubit® fluorometer | Q32857 |
| Quant-iT™ dsDNA HS Assay Kit, for use with the Qubit® fluorometer | Q32851 |
| Quant-iT™ dsDNA BR Assay Kit, for use with the Qubit® fluorometer | Q32850 |
| **DNA polymerase** | |
| Platinum® qPCR SuperMix-UDG for SNP Genotyping, 250 rxns | 11729-008 |
| Platinum® qPCR SuperMix-UDG for SNP Genotyping, 1250 rxns | 11729-016 |