



# From crime scene to identification

Human identification and forensics: Advanced workflow solutions

# Streamline your workflow – Optimize human identity and

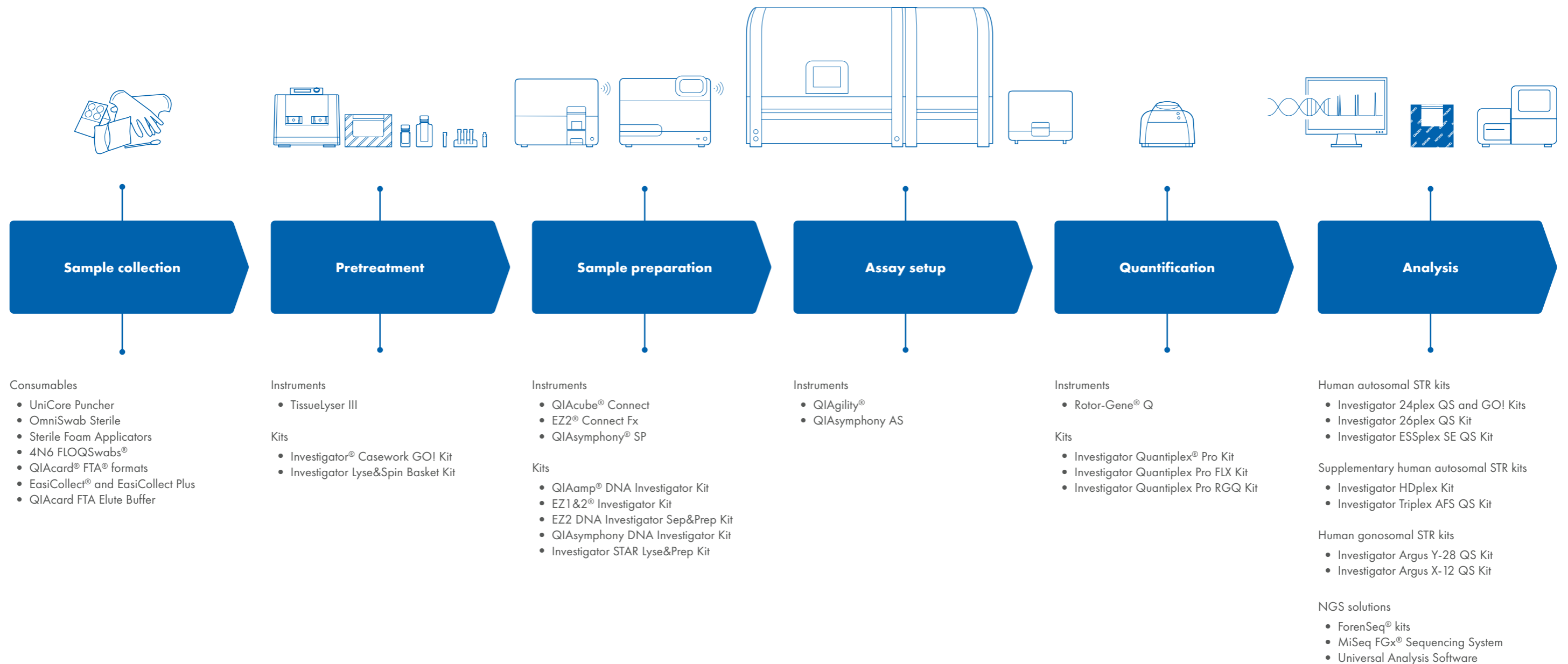
# forensic testing with QIAGEN® solutions

Forensic and paternity laboratories are often faced with increasing workloads, due to growing demand for DNA testing. To reduce costs and increase efficiency, productivity and quality of laboratory operations, forensic facilities like yours are required to optimize their workflows. This is why

QIAGEN has developed high-quality automation, sample collection and preparation consumables, as well as assay solutions designed to meet your needs, whether you belong to a smaller lab or a higher-throughput facility.

All Investigator products have been validated according to recommendations of the European Network of Forensic Science Institutes (ENFSI) and the Revised Validation Guidelines of the Scientific Working Group on DNA Analysis Methods

(SWGDM). QIAGEN can help your forensic laboratory standardize sample processing, and enable you to achieve consistent high-quality results – from Sample to Insight!



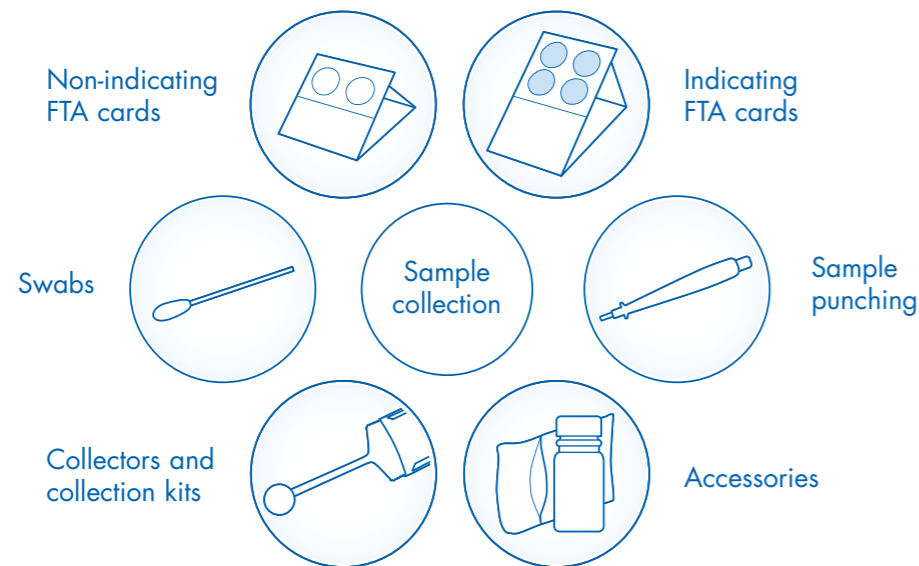
# Responsibility from the start

## Reliable QIAcard FTA technology and EasiCollect solutions for casework sample collection, safe storage and high-quality DNA processing.

Dried samples are an excellent solution for long-term stabilization at room temperature. You can collect, transport, store and analyze your samples with relative ease. This simplifies handling and reduces cost.

Whether you're performing reference or casework sample collection, looking to store and protect the integrity of your precious samples under all conditions, or even considering customized kits for your workflow, we have a solution for you.

**QIAcard FTA**  
QIAcard FTA is a chemically coated cellulose matrix with impregnated chemistry capable of lysing cells upon contact and denaturing proteins. Indicating card formats change from colored to white upon sample application. Released DNA is trapped on the card and protected from degradation. This smart storage technology allows you to store your samples at room temperature for decades. QIAcard FTA Elute formats are designed for room temperature shipment, stabilization and subsequent elution of extracted nucleic acids from biological samples.



### Multiple sample collection solutions

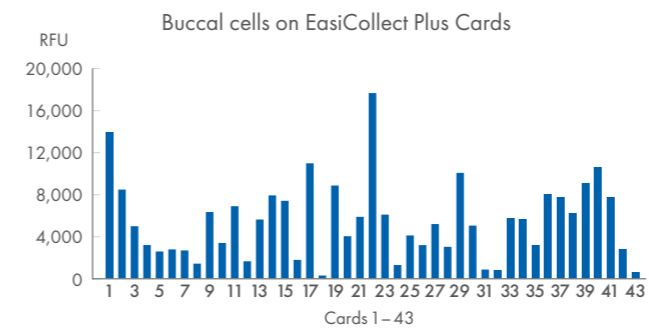
- Collectors and collection kits – For simple, reliable and standardized sample collection
- Indicating FTA cards – For collection, stabilization, processing, transport and storage of buccal and saliva samples
- Non-indicating FTA cards – For collection, stabilization, processing, transport and archiving of blood samples
- Sample punching – For precise sample disc removal from FTA cards
- Swabs – Foam swabs, 4N6 FLOQSwabs for the smallest amounts of DNA and OmniSwabs with ejectable head for buccal and saliva samples
- Accessories – For contamination-free collection, storage, transport and processing of DNA samples
- Custom solutions – For creating optimized solutions that fit into your workflow

### EasiCollect and QIAcard FTA

EasiCollect and EasiCollect Plus are all-in-one single-use products designed specifically for the collection and storage of buccal samples for genetic analysis. These products allow cells to be uniformly captured on a foam applicator by swabbing the inside of both cheeks and then transferred to an integrated Indicating FTA card.

Subsequent analysis of sample material on QIAcard FTA formats or EasiCollect devices can be processed via direct PCR. A direct PCR with the punched paper disc included in the PCR mix can be streamlined with tailored ready-to-go STR kits, e.g., Investigator 24plex GO! Kit.

**See section Direct amplification of reference samples for more information.**



**Figure 1. Relative peak heights of all 43 samples processed – all 43 samples gave full, balanced profiles.** Significant variation in peak heights between samples is typical of buccal samples and can be heavily influenced by sample collection and DNA availability from the subject.

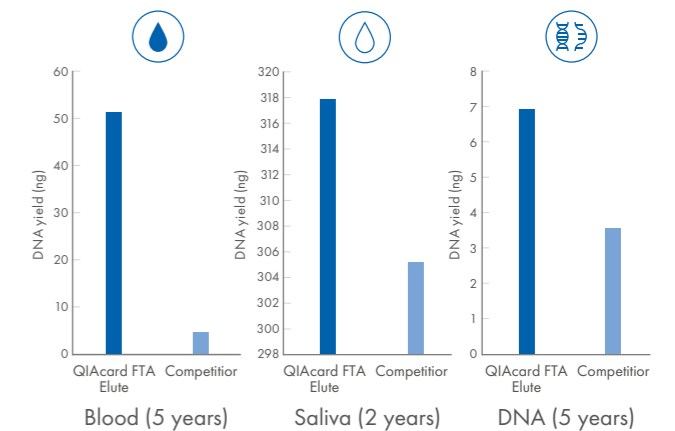


For more information and a full list of products, go to [www.qiagen.com/forensic-sample-collection](http://www.qiagen.com/forensic-sample-collection)



### QIAcard FTA Elute

QIAcard FTA Elute formats are designed for room temperature shipment, stabilization and subsequent elution of released nucleic acids from biological samples. For purification of previously applied DNA or RNA to the FTA Elute cards, the use of QIAcard FTA Elute Buffer is sufficient. The recovery of nucleic acids from biological fluids requires the addition of Proteinase K and Investigator Lyse&Spin Basket Kit.



**Figure 2. Recovery of sample material compared with competitor product.** Different sample material such as blood, saliva and purified human gDNA were applied to QIAcard FTA Elute formats and accelerated aging studies showed significant differences in comparison to the competitor product. Full STR profiles were obtained from DNA stored on QIAcard FTA Elute formats for all sample materials (data not shown).

**Customization:** In addition to our catalog products, we can create customized kits fitting your application and workflow. Your kit can include any of our QIAcard FTA products or other sample collection products and accessories including customized card artwork and formats.

# Sample pretreatment for best results

## Investigator Lyse&Spin Basket Kit

### Reduced sample handling and complete nucleic acid recovery

Investigator Lyse&Spin Basket Kit is used for pretreatment of forensic samples, in combination with manual and automated extraction kits, such as QIAamp DNA Investigator Kit, EZ1&2 DNA Investigator Kit, QIASymphony DNA Investigator Kit and Investigator STAR Lyse&Prep Kit. The kit enables you to perform sample lysis and separation of solid sample substrates at the same time (for example, swabs, pieces of fabric or leather, paper, cigarette butts, chewing gum or small tapes), in one simple procedure.

- Front-end solution for sample pretreatment
- Lysis at 56°C for up to 16 hours without leaking
- Filtration of lysates and retention of particles >10 µm
- EO-treated bulk or single blistered kit configurations

## TissueLyser III

### Disruption of bone or teeth samples

TissueLyser III (Figure 3) bead mill is capable of grinding challenging bone or tooth samples to a fine powder in just a few minutes, using liquid nitrogen for the grinding jar set of the instrument.

- Grinds bones or teeth until pulverized
- Convenient and secure disruption process
- Reproducible results with difficult-to-lyse tissues
- Adapter sets optimized for high-throughput disruption
- Front-end solution for QIAGEN sample preparation

## Investigator Casework GO! Kit

### Pretreatment and direct amplification of casework samples

Investigator Casework GO! Kit accelerates the casework analysis workflow. It allows the rapid processing of swabs from casework samples on a variety of substrates, including sexual assault swabs, pieces of fabric, paper, cigarette butts, chewing gum and other sample types.

The generated lysates are compatible with all Investigator Quantiplex and Investigator STR QS Systems.



Figure 3. TissueLyser III.

# QIAcube Connect – The all-in-one instrument

## Simple automated DNA purification from forensic samples

QIAcube Connect uses advanced technology to process QIAGEN spin columns, enabling you to seamlessly integrate automated, low-throughput sample prep into your laboratory workflow. The proven silica membrane technology of QIAamp DNA Investigator Kit provides you with high-quality DNA suitable for direct use in downstream analysis or storage for later use. Pretreatment protocols are available for various typical casework or reference sample types.

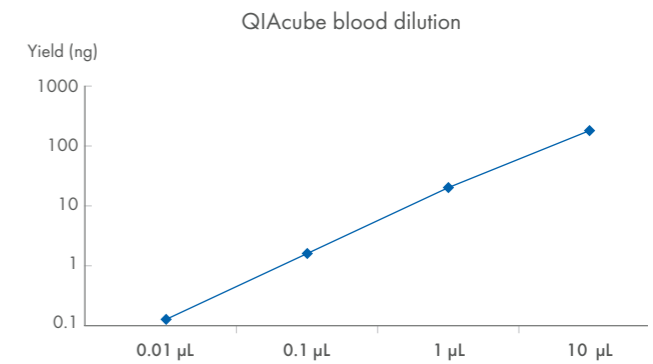


Figure 4. Linear correlation of input sample amount and purified DNA, performed on a QIAcube Connect instrument.



Figure 5. QIAcube Connect

## Convenient automation of sexual assault samples

But sample prep is not all. QIAcube Connect also offers specially designed differential wash protocols for effective lysis and careful separation of the sperm and non-sperm fractions from sexual assault samples.

# Automate with HID flagship EZ2 Connect Fx for of sample types

Simplicity. Safety. Speed.

## Fast and efficient workflow

- Purify high-quality DNA and RNA in under 20 minutes
- Increase lab throughput by processing up to 24 samples in parallel and 288 samples per day – with just one instrument

## Maximum process safety

- Achieve reproducibility and convenience with prefilled, ready-to-use forensic grade reagent cartridges
- Have confidence in your sample processing with an internal camera to scan and check for proper loading of samples and consumables
- Recover DNA from samples in the event of an error or aborted run using easy-to-follow instructions for sample recovery capabilities
- Full worktable decontamination in one easy step with high emission UV-LED

## Trusted chemistry

- Benefit from magnetic-bead purification technology you know and trust
- Easily access a variety of dedicated human ID and forensics protocols at the push of a button
- Prepare a wide range of sample types for various downstream forensics applications



Figure 6. EZ2 Connect Fx

Meet your lab's need for increased throughput, reproducibility and flexibility with EZ2 Connect Fx. This benchtop instrument automates processing of up to 24 samples at a time in around 20 minutes\* using magnetic-bead purification technology. Isolate high-quality DNA from a wide range of sample types, such as cigarette butts, saliva, blood, touch samples, bone and semen.

\* Extraction protocol with EZ2 DNA Investigator Sep&Prep Kit is 70 minutes

Benefit from the flexibility of EZ2 Connect Fx in sample input and elution volumes. Protocols allow for up to 2 mL of input lysate and for a range of elution volumes from 20 µL – 200 µL. Plus, with its remote connectivity feature, you can monitor your runs and manage your instrument even from outside the lab.

# high-quality nucleic acids from a wide range

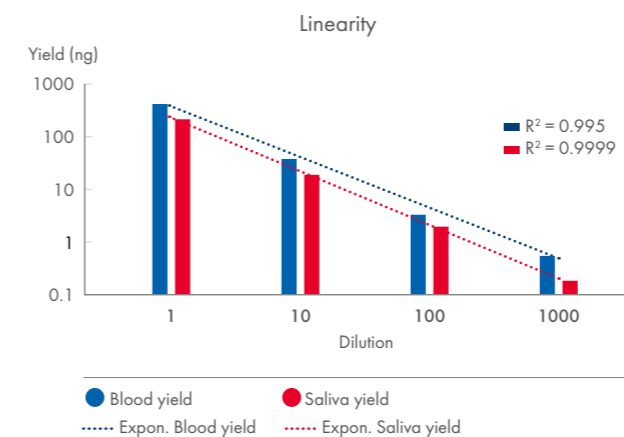
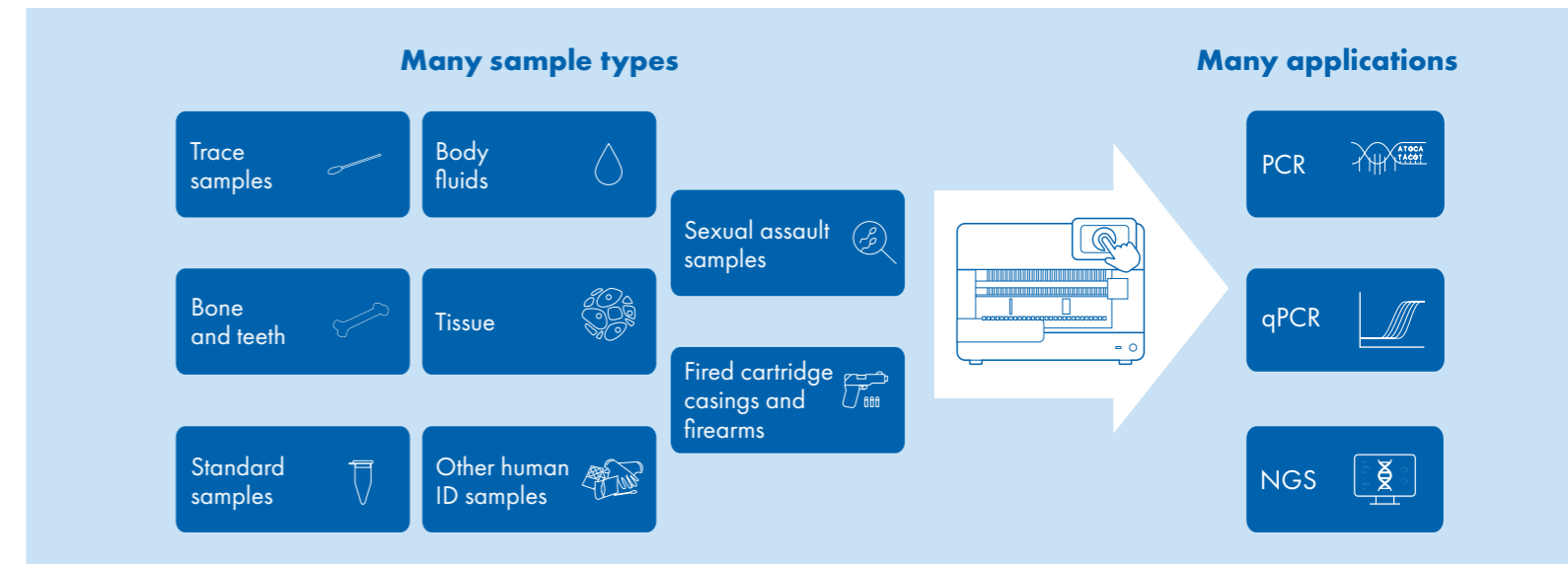


Figure 7. Linearity. Blood and saliva dilutions were extracted in triplicates on EZ2 Connect Fx. The dilution series corresponds to 10, 1, 0.1, and 0.01 µL blood or saliva sample.

Read these application notes to learn how EZ2 Connect Fx performs against other forensic DNA extraction platforms.

**Comparison of two DNA extraction platforms for use in forensic casework applications: EZ2 Connect Fx versus AutoMate Express**

**Comparison of two DNA extraction platforms for use in forensic casework applications: EZ2 Connect Fx versus Maxwell FSC Instrument**

# EZ2 DNA Investigator Sep&Prep Kit

## Automated processing of sexual assault samples using EZ2 Connect Fx

1 in 3 women experience physical or sexual violence in their lifetime (1). This statistic represents a growing burden on forensic laboratories. Traditional differential extraction methods are often limited by sample quality, or the number of samples submitted. Inefficient separation of sperm cells from the non-sperm fraction – especially when female cells greatly outnumber male ones – compromises downstream DNA analysis.

Streamline the extraction process with EZ2 DNA Investigator Sep&Prep Kit. The fully automated solution enables separation of sperm cells from non-sperm cells and preparation of the sperm-derived DNA for direct use in downstream applications.

### Key features

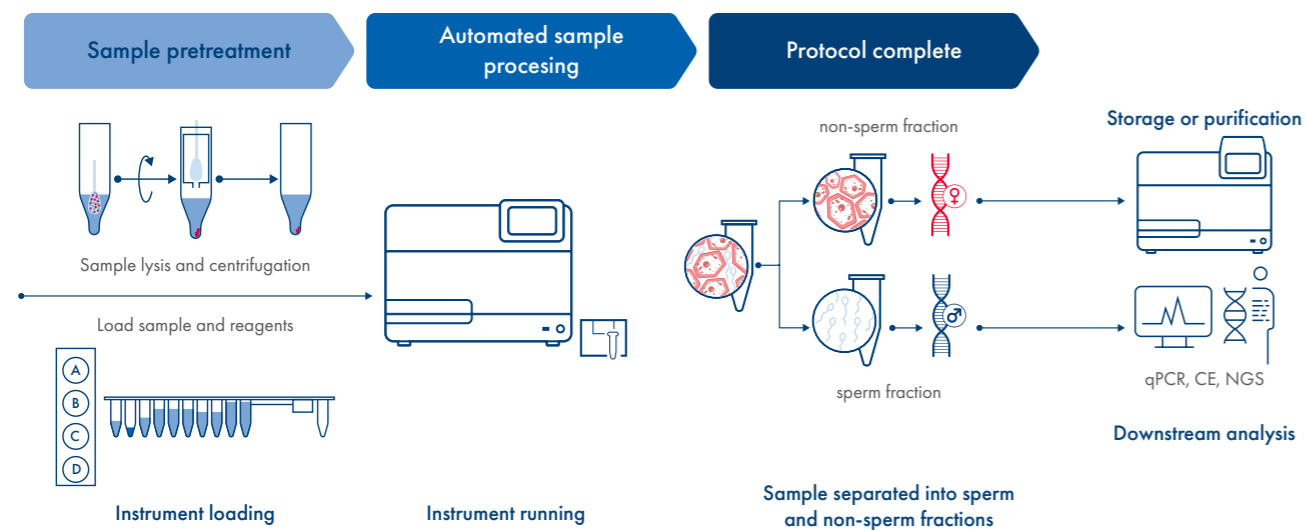
- Automated sexual assault sample processing of 1–24 samples per EZ2 Connect Fx run
- Improved release of sperm cells from substrate

- High recovery of sperm-derived DNA with minimal female carryover
- Reduced hands-on time
- Sperm fractions ready for downstream analysis and compatible with commercial kits (qPCR, STR and NGS)

### Workflow overview

The EZ2 DNA Investigator Sep&Prep workflow significantly reduces hands-on time compared to other differential extraction methods. After sample lysis and centrifugation, all remaining steps are automated on EZ2 Connect Fx limiting the manual interaction in sexual assault sample processing to around 20 minutes, even for a full batch of 24 samples.

(1) United Nations webpage: <https://unstats.un.org/unsd/gender/chapter6/chapter6.html>



# QIAgility for automated high-precision liquid handling

## Flexible benchtop instrument for reproducible assay and capillary electrophoresis (CE) plate setup

QIAgility is a compact benchtop instrument that helps you save time by enabling rapid, high-precision PCR and CE setup, and providing standardization, traceability and highly accurate pipetting (Figure 8). The unmatched versatility of QIAgility means that almost all tube and plate formats are supported, as well as Rotor-Discs® for Rotor-Gene Q.

For PCR success at the first attempt, you can use verified prewritten and ready-to-run Q Protocols for PCR setup in combination with QIAGEN PCR kits for end-point and real-time PCR.

- Assay setup for quantitative real-time PCR and STR analysis
- Normalize up to 64 DNA samples in a single run
- Import sample IDs and concentration data directly from the normalization protocol
- Automatic addition of DNA extract at the recommended template input

Manually setting up 96-well plates for CE to obtain STR profiling results is time-consuming and prone to error. QIAgility can set up a 96-well plate for CE in just 34 minutes, including dispensation of Hi-Di™ Formamide/size standard mix, samples and allelic ladders.

- Prewritten protocols for CE plate setup with fixed or user-defined ladder positions
- High accuracy by sensing the meniscus during pipetting and retracting the tip while dispensing to prevent bubbles in the Hi-Di Formamide/PCR product mixture that could result in failed injections

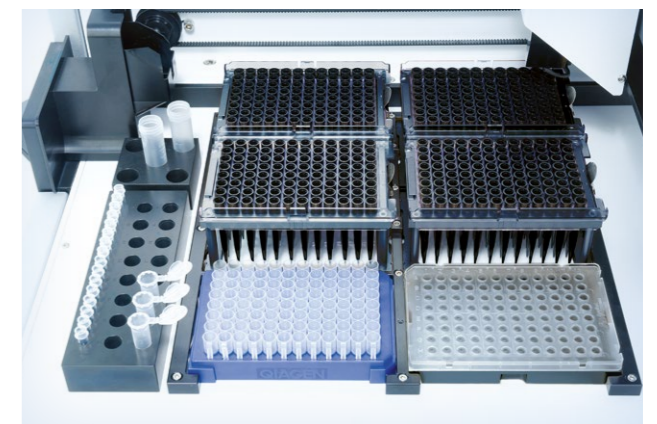


Figure 8. QIAgility instrument and deck layout.

# QIASymphony SP/AS – In tune with your DNA

## Sample purification and assay set up with one versatile instrument

QIASymphony SP/AS offers you unequalled quality in medium- to high-throughput DNA sample purification (SP) and assay setup (AS) for human identity and forensic analyses.

- QIASymphony DNA Investigator Kit in prefilled, sealed reagent cartridges
- Continuous loading in batches of up to 24 samples
- Option to assign different protocols to each batch
- Different protocol options to ensure maximum DNA recovery
- Automated transfer of eluates from the SP to the AS module for assay setup

With improved handling of difficult samples and subsequent assay setup options, this modular system offers you excellent performance, traceability and LIMS compatibility.



Figure 9. The QIASymphony instrument with the SP and AS module.

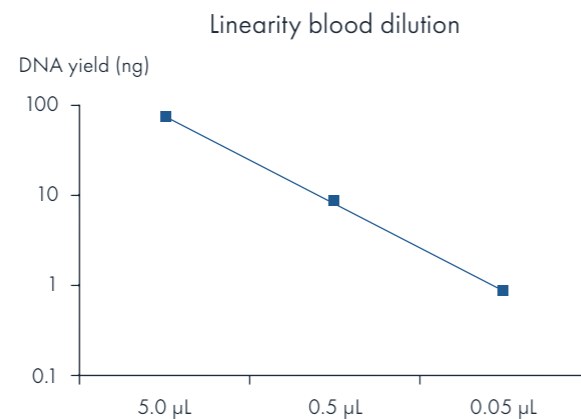


Figure 10. Linearity of blood dilution. Lysis and filtration using Investigator Lyse&Spin Basket Kit is shown. Extraction was carried out on QIASymphony SP with the Casework 500 ADV protocol with 50 µL elution. Investigator Quantiplex Kit was utilized for quantification of human DNA.

## High-efficiency forensic protocols for the QIASymphony

We have developed sample preparation protocols that ensure high first-pass success rates for your most difficult forensic samples. Advanced protocols (ADV) use a heated binding step and increased binding time to maximize yields of pure DNA.

High-Efficiency (HE) protocols with TopElute Fluid maximize sensitivity for recovering DNA from touch and other low-template samples. The full range of high-efficiency forensic protocols available for different reference and casework samples is described in Table 1.

Table 1. Forensic protocols for QIASymphony

Protocol	Lysis volume options	Enhanced binding	Eluate volume	TopElute Fluid
Reference	200, 500 µL	No	100–400 µL	No
Casework	200, 500, 1000 µL	No	100–200 µL	No
Casework ADV	200, 500, 1000 µL	Yes	100–200 µL	No
Casework HE	200, 500, 1000 µL	No	30–80 µL	Yes
Casework HE ADV	200, 500, 1000 µL	Yes	30–80 µL	Yes

## Forensic workflow integration

If your laboratory is already operating a QIASymphony SP, you can upgrade your system on site with a QIASymphony AS module and use the module as an independent or integrated liquid handler.

QIASymphony AS extends the capabilities of QIASymphony SP by integrating automated PCR assay setup, for both real-time quantification and CE STR assays.

- Automated serial dilution of quantification standards
- Import of concentration data from real-time cyclers
- Normalization of samples for STR assay setup
- User-defined target amount, minimum and maximum

## Investigator STAR Lyse&Prep Kit

Investigator STAR Lyse&Prep Kit is designed for automated purification of DNA from forensic samples using open DNA extraction platforms. The kit delivers the same chemistry as QIASymphony DNA Investigator Kit. The magnetic particle format is suitable for DNA extraction platforms from a third-party supplier such as Hamilton, TECAN, or others.

- Optimized pretreatments allow different sample types to be processed
- Adjustable input volumes for use with Investigator Lyse&Spin Basket Kit
- Purified DNA performs well in downstream analyses

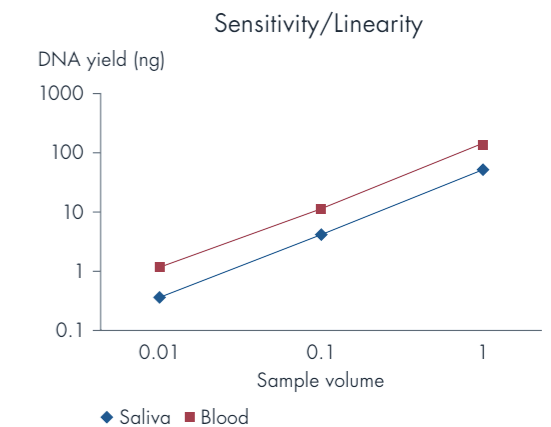


Figure 11. Sensitivity and reproducibility of Investigator STAR Lyse&Prep Kit. Data was generated using the 300 µL protocol on the Hamilton STAR instrument.

# Quantification – More insight for confident decisions

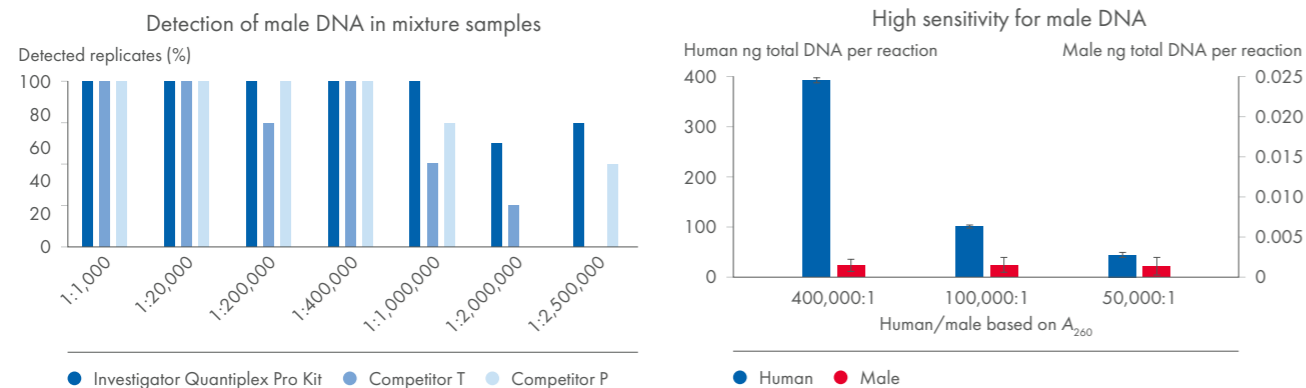
## Investigator Quantiplex Pro and Investigator Quantiplex Pro RGQ Kits

Our quantification portfolio supports you to choose the best downstream analysis path for a critical forensic sample. Arm yourself with the tools you need for a confident decision. You can count on Investigator Quantiplex Pro Kits to maximize information through consistent, accurate, reliable screening. Make the right choice. Triage your samples with Investigator Quantiplex Pro Kits.

- Simple reaction set up
- Broad dynamic range
- Accurate quantification of low-level DNA
- Sensitive detection of male DNA in high female background
- Effective detection of inhibition and human and male\* degradation
- Easy integration into your high throughput, automated workflows

## High sensitivity and accurate male/female ratio

### Outperforming other kits detecting male DNA in high female background



**Figure 12. Highly accurate and sensitive results for male DNA.**

Different mixture sets were tested. Each set contains a total of 1 pg of male DNA, while the amount of female DNA was increased. Left: Investigator Quantiplex Pro outperforms competitor products in quantification accuracy, and provides more precise results even with low DNA inputs. Right: Investigator Quantiplex Pro Kit accurately quantified the increasing amount of female DNA, whereas the amount of male DNA was consistently quantified at approximately 1 pg in total.

\* Investigator Quantiplex Pro RGQ only

## Investigator Quantiplex Pro FLX Kit for flexibility and convenience

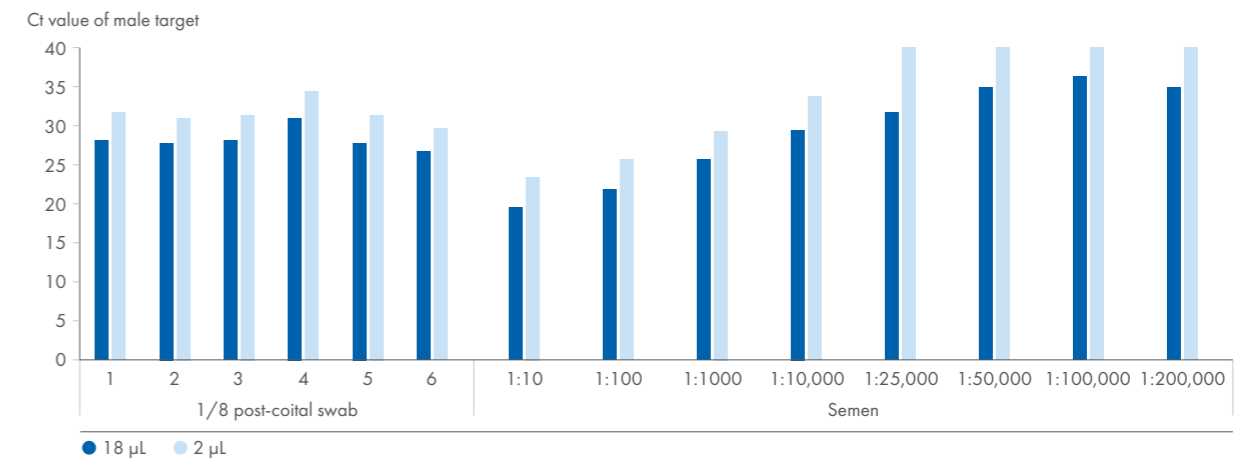
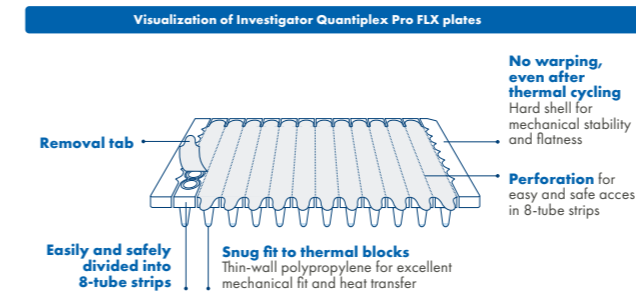
Do you need higher sensitivity for low-level DNA casework samples? Do you want to speed up your processes with less hands-on time? How can you take sexual assault screening to the next level in your lab? Investigator Quantiplex Pro FLX has the answers. Investigator Quantiplex Pro FLX Kit combines trusted multicopy markers for advanced assessment of quantity, degradation and inhibition with novel lyophilized chemistry in 96-well optical plates. Investigator Quantiplex Pro FLX Kit is the next generation of quantification in human identification testing.

### So, why FLX?

- Ready-to-use 96-well optical plates pre-filled with lyophilized qPCR Master Mix
- Trusted multicopy markers for assessment of quantity, degradation and inhibition
- Full flexibility with option to scale input volume from 1 µL to 18 µL for highest sensitivity
- Breakable plates and convenient seal removal to size for the throughput needed
- Sustainable room temperature storage to free-up freezer capacity

### Investigator Quantiplex Pro FLX features

- Easy and safe, breakable into 8-tube strips
- Enhanced mechanical stability for manual or automatic robotic handling
- Validated with Applied Biosystems® 7500 and QuantStudio® 5 series



**Figure 13. Quantification with a larger input sample volume is consistently approximately 10-fold higher.**

A sample of 1/8 swab was cut from postcoital swabs and processed with Investigator Casework GO! Kit.

Dilutions of a semen sample were spotted directly onto swabs and the whole swab was processed with Investigator Casework GO! Kit. After lysis, 2 µL or 18 µL volumes were analyzed with Investigator Quantiplex Pro FLX Kit.



Learn more about our quantification solutions for human identity and forensic testing at: [www.qiagen.com/QuantiplexKits](http://www.qiagen.com/QuantiplexKits)

# STR analysis – Have confidence in your evidence

## The right STR kit for the right sample

When preparing to give evidence in court, you need to have an STR profile you can trust. QIAGEN offers a broad portfolio of multiplex PCR kits for human identification and paternity testing that allow you to do just that – trust in your evidence.

Sometimes, standard autosomal kits are not sufficient to resolve a case and further genetic markers are needed. Conversely, there are situations where you need only a few, highly discriminating markers. We offer a broad range of unique solutions for complex deficiency cases, ChrX or ChrY analysis, as well as prescreening solutions with triplex subsets.

- International compatibility with CODIS core, ESS or Chinese loci
- Compatibility for direct amplification of reference samples and challenging case-work samples after DNA purification
- Combinatorial kits with non-standard markers or triplex applications
- Very high sensitivity and inhibitor resistance
- Smart primer design for minimal allelic overlap, reducing the risk of misinterpretation
- Inbuilt quality control with Quality Sensor (QS).

## Autosomal STR assays in casework analysis

A clean baseline and high sensitivity are crucial for a successful STR profile. The QIAGEN Investigator STR products offer the sensitivity and robustness you need.

### Kit options for standard autosomal STR

- **Investigator 24plex QS Kit** – for analysis of the CODIS expansion marker set
- **Investigator 26plex QS Kit** – for analysis of all Chinese, CODIS and ESS markers
- **Investigator ESSplex SE QS Kit** – for analysis of the ESS standard set including SE33

These kits offer the following features:

- Fast results with a PCR speed of around 60 minutes
- Highest pass rate for the most challenging samples
- Added information with Quality Sensor
- Compatible with Investigator Casework GO!

The following kits are offered for supplementary aSTR analysis:

- **Investigator HDplex Kit** – amplifies 12 autosomal STR markers not featured in commonly used marker standards
- **Investigator Triplex AFS QS Kit** – enables simultaneous amplification of STR loci FGA (FIBRA), SE33 (ACTBP2) and Amelogenin

## Gonosomal STR assays for ChrX and ChrY analysis in casework and kinship analysis

### Investigator Argus X-12 QS Kit

ChrX genotyping can complement the analysis of autosomal and ChrY markers very efficiently, especially in complex cases of kinship testing or in paternity cases involving close blood-relatives as putative fathers. Here, the exclusion power of STRs is considerably reduced and ChrX STRs may be superior to autosomal markers. For example, if two alleged fathers are father and son, they would not share any X-chromosomal alleles identical by descent, and hence ChrX markers would be more efficient than AS markers. Besides kinship and paternity testing, the kit is also highly suitable for forensic stain analysis, such as female traces on a male background. The 12 X-chromosomal STR markers are clustered into four linkage groups (Table 2), and thus, each set of three markers is handled as a haplotype for genotyping.

### Investigator Argus Y-28 QS Kit

Investigator Argus Y-28 QS Kit is designed to process highly challenging Y-STR casework and database samples. It is optimized to help improve resolution of trace evidence and sexual assault mixtures that contain small quantities of male DNA in a large background of female DNA and offers laboratories both the power of discrimination and the performance to enable accurate results in less time from challenging samples – For sure it contains the Quality Sensor and it is compatible with Investigator Casework GO!.

The most useful applications for Investigator Argus X-12 QS Kit include:

- Paternity with related putative fathers (superiority of ChrX-markers if father/son)
- Paternity testing for daughters (only ChrX of males is transmitted to all females)
- Motherhood (verification of mother/son)
- Sisterhood (identical paternal ChrX-haplotype)
- Deficiency cases with missing putative father (reconstruction of family trees)

**Table 2. Linkage groups of Investigator Argus X-12 QS Kit**

Linkage group	
1 (Xp22)	DXS8378 – DXS10135 – DXS10148
2 (Xp11)	DXS7132 – DXS10074 – DXS10079
3 (Xp26)	HPRTB – DXS10101 – DXS10103
4 (Xp28)	DXS7423 – DXS10134 – DXS10146

The features of Investigator Argus Y-28 QS Kit include:

- Co-amplification of 27 Y-chromosomal loci including 17 of the most commonly used markers
- An integrated Quality Sensor for better decision making and data interpretation
- Best in class performance with degraded samples and PCR inhibitors
- Dedicated for casework samples with high female input



For better quality control in your STR analysis, see [www.qiagen.com/qualitysensor](http://www.qiagen.com/qualitysensor)



Go to [www.fbi.gov](http://www.fbi.gov) to learn more about CODIS and NDIS.

# Whatever your throughput of reference samples is – we have the right assays and tools to support you

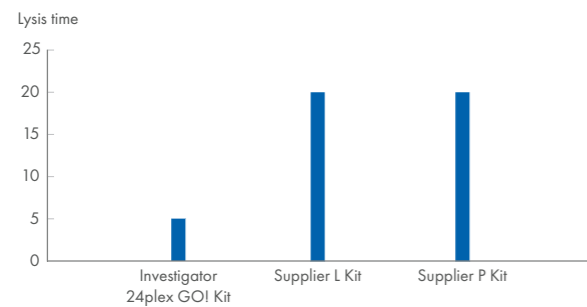
## Direct amplification of reference samples

Direct amplification can increase throughput and simultaneously decrease the complexity of STR analyses. This reduces costs and minimizes the potential for errors. Our assays offer specific optimized direct protocols without the need for sample purification, for blood or saliva on FTA

papers or buccal swabs. The Quality Sensor lets you see whether there is a lack of DNA or an unsuccessful PCR. This streamlines your decision-making process and lets you focus your resources optimally. Available kit or protocol options are shown in Table 3.

**Table 3. Overview of Investigator STR PCR portfolio of reference samples**

Kit	Quality Sensor	Marker set	Number of STR markers	Direct amplification from paper or swabs	Amplification from purified DNA
Investigator 26plex QS Kit	●	Autosomal standard	24	Supplementary protocol	●
Investigator 24plex QS Kit	●	Autosomal standard	22	Supplementary protocol	●
Investigator 24plex GO! Kit	●	Autosomal standard	22	●	●
Investigator ESSplex SE QS Kit	●	Autosomal standard	16	Supplementary protocol	●
Investigator Argus X-12 QS Kit	●	XChr/autosomal	12/1	Supplementary protocol	●
Investigator Argus Y-28 QS Kit	●	YChr	28	Supplementary protocol	●



These kits offer the following features:

- Ideal for reference samples from buccal cells or blood on FTA paper or buccal swabs
- Swab lysis in just 5 minutes (see Figure 14)
- Validated protocols for automated sample punching and reaction setup

**Figure 14. Quicker swab lysis for direct amplification.**

The effective swab lysis time of the Investigator STR GO! Lysis Buffer for the Investigator 24plex GO! Kit protocol, and swab lysis times for other suppliers, are shown.

Read these supplementary protocols to learn about using Investigator STR kits for direct amplification of blood or saliva on FTA papers or buccal swabs.

**Direct amplification of FTA and swab samples using the Investigator Argus X-12 QS Kit**

**Direct amplification of DNA using the Investigator 26plex QS Kit**

**Direct amplification of DNA using the Investigator 24plex QS Kit**

**Direct amplification of DNA using the Investigator ESSplex SE QS Kit**

**Direct PCR amplification of STR loci from Bode Buccal DNA Collectors**

## Low throughput/manual sample handling

The **UniCore Punch system with Cutting Mat** is an easy, cost-effective manual punch system for precise sample disc removal from FTA cards.

## Medium throughput/semi-automated sample handling

The **BSD600 Ascent A2** is the fourth generation of BSD punchers and suitable for medium to higher punching throughput and more complicated test sequences. For more information and support on BSD instruments please contact our partner BSD Robotics Pty Ltd: [bsd@bsdrobotics.com](mailto:bsd@bsdrobotics.com)

## High throughput/fully automated sample handling

The **easyPunch STARlet** from Hamilton is an optimized assay-ready workstation to streamline pre-PCR workflow steps from a variety of evidentiary and DNA databasing biological samples collected via FTA cards.

For more information and support on using QIAGEN chemistry on Hamilton instruments please contact our Tech Service department.



**Figure 15. Reference sample processing.**

A UniCore Punch system, B BSD Puncher, C easyPunch STARlet

Read these papers to learn about automation of Investigator STR kits for direct amplification of blood or saliva on FTA papers.

**Fully automated punching and setup for direct amplification of FTA card samples using QIAGEN Investigator STR GO! kits on the Hamilton easyPunch STARlet workstation**

**High-throughput assay setup for the Investigator 24plex GO! Kit from Bode Buccal 2 Assembled Cassette samples using the Hamilton easyPunch**

**High-throughput Investigator 24plex GO! PCR setup from EasiCollect Plus cards using the STAR Q Punch AS instrument**

# NGS - Better outcomes from forensic casework, and more

## Move your investigation forward with next-generation sequencing

Next-generation sequencing (NGS) gives you the power to generate much more than just a basic DNA profile. In addition to analyzing STRs, NGS can be used to analyze mitochondrial DNA and detect SNPs useful to establish identity, estimate externally visible characteristics and provide both short- and long-range kinship information.

Start with trusted QIAGEN tools for sample collection, preparation and quantification. Follow up with ForenSeq kits, MiSeq FGx Sequencing System and Universal Analysis Software to prepare and sequence libraries and analyze data in a single workflow. This suite of capabilities delivers everything you need to make identifications with greater impact in forensic casework, databasing, relationship testing or collecting data on missing persons cases.

## STR analysis with NGS

NGS on the MiSeq FGx Sequencing System eliminates many of the challenges of STR analyses with a base-by-base approach that allows you to obtain more detailed information.

**ForenSeq MainstAY Kit** focuses on the core autosomal STRs in the European and expanded CODIS loci sets, as well as Y-STRs. This kit is approved for NDIS upload.

**ForenSeq MainstAY SE Kit**, part of the ForenSeq MainstAY product line, targets the same autosomal and Y-STRs, while also including the highly polymorphic SE33 marker.

**ForenSeq Signature Plus Kit** targets autosomal, X- and Y-STRs and SNPs in a single amplification. Targeting all these markers at once enables a maximum amount of information to be recovered from a single analysis when complex cases require it.

## Kinship analysis with NGS

Kinship analysis covers a broad range of applications. These include paternity testing, forensic investigative genetic genealogy (FIGG) and identification of recovered remains in missing persons inquiries or mass disasters.

Detect circulating cell-free fetal DNA in maternal blood for noninvasive prenatal paternity testing (NIPPT) early in gestation. Target the most common autosomal and Y-STR markers in a single analysis with the **ForenSeq MainstAY product line**.

**ForenSeq Signature Plus Kit** targets autosomal, X- and Y-STRs and SNPs providing more information for kinship cases where first-degree relatives are not available.

For the most complex kinship scenarios, reach third-, fourth- and fifth-degree relatives with the focused power of 10,230 SNPs in **ForenSeq Kintelligence Kit and ForenSeq Kintelligence HT Kit**.

# databasing, missing persons investigations,

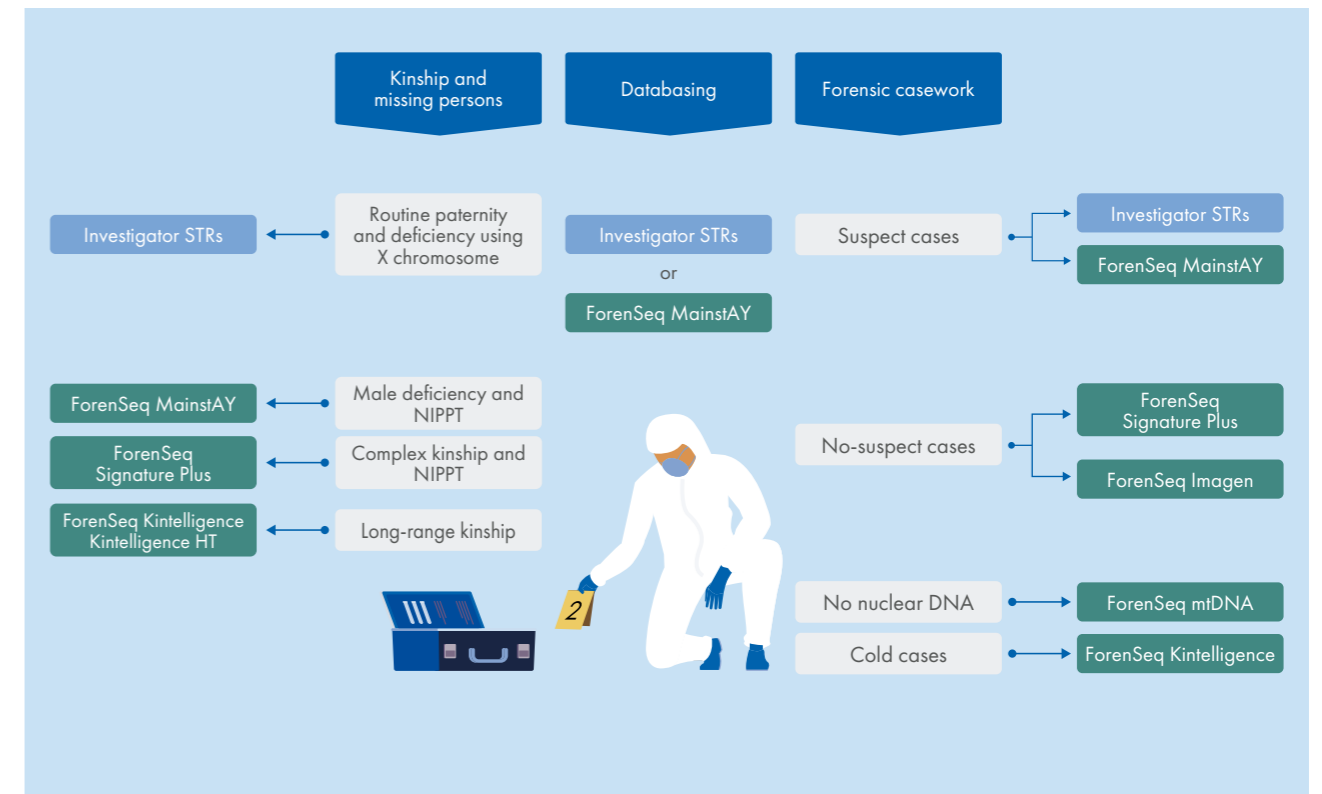


Figure 16. The right kit for your application - analysis, kinship, casework, research or operations.

## Forensic investigative genetic genealogy (FIGG)

FIGG combines consumer DNA testing with traditional genealogical research to generate investigative leads in violent crime and unidentified persons and remains cases. FIGG identifies potential relatives by analyzing SNPs and comparing these against a database of genetic data from genealogy websites.

GEDmatch® is a public website and online service that facilitates comparison of a genetic profile obtained from a DNA testing kit company with profiles of other GEDmatch members. GEDmatch PRO is a dedicated portal that separates law

enforcement comparisons of GEDmatch data from standard genealogy activities and offers a range of tools most relevant to help further investigations. **ForenSeq Kintelligence Kit** workflow is designed specifically for forensic sample analysis and supports FIGG through GEDmatch PRO.

## Repurposing FIGG tools for unidentified human remains

**ForenSeq Kintelligence HT Kit** combines high-throughput targeted SNP sequencing and a dedicated kinship analysis database for the large-scale identification of human remains. An optimized PCR buffer overcomes challenges with particularly inhibited bone samples.

### Externally visual characteristics

**ForenSeq Imagen Kit** incorporates up to 111 externally visual characteristics (EVC) SNPs for both biogeographical ancestry inference and phenotype estimation. The kit is an optimized solution for operational forensic labs considering implementing an NGS-based lead generation workflow for no-suspect cases.

**ForenSeq Signature Plus Kit** and **ForenSeq Kintelligence Kit** combine 76 SNPs for eye color, hair color and biogeographical inference with STRs and/or identity SNP markers respectively.

### Mitochondrial DNA

Mitochondrial DNA (mtDNA) is a robust source of genetic information and can be a plentiful alternative to nuclear DNA. **ForenSeq mtDNA Whole Genome Kit** and **ForenSeq mtDNA Control Region Kit** make library preparation for interrogating mtDNA convenient and efficient with optimum sensitivity from minimal DNA input.

### Begin your NGS journey today

The MiSeq FGx Sequencing Solution is a fully validated NGS system designed for the challenges of forensic laboratories.

Dedicated library prep kits, reagents and integrated software, backed by QIAGEN support and services, create a solution ready for immediate adoption into operational laboratories.

With the system in place, your laboratory can realize the full suite of NGS capabilities including STR and mtDNA analysis, kinship determination and estimation of externally visible characteristics.

The MiSeq FGx Sequencing System is a single-platform solution built on gold standard NGS technology. Paired with the Universal Analysis system (UAS), there is seamless communication for ease of data analysis. The UAS is an all-inclusive solution, containing analysis modules supporting all current ForenSeq workflows.

# QIAGEN Forensic DNA Grade quality

## High-quality Investigator solutions

### Trust in your results with QIAGEN Forensic Grade products

In criminal investigation, the introduction of foreign DNA to a crime scene sample, either at the scene itself or during laboratory analysis, can have devastating consequences for the examination. As a manufacturer of consumables used to collect and analyze samples from crime scene or reference materials, QIAGEN has a broad range of quality measures in place to guarantee highest product quality and safety. Our Investigator branding and Forensic Grade labels (Figure 17) demonstrate compliance with industry-leading quality control systems, and exacting manufacturing standards which includes:

- ISO 9001:2008
- Production in clean-room compliant to ISO 14644 standard and EU guidelines on GMP for Medicinal Products for Human and Veterinary Applications
- Risk analysis of manufacturing processes for potential exogenous human DNA
- Cleaning and environmental monitoring procedures
- Automated manufacturing and EO treatment whenever feasible
- Testing for absence of human DNA post-production before batch release
- Contamination Exclusion Database service

As part of the stringent and process oriented quality management system, all Investigator kits are manufactured in ISO-certified facilities. This ensures that they comply with the applicable regulatory requirements. To further ensure consistent high quality, each kit lot is tested against pre-determined specifications and for absence of human DNA post production.

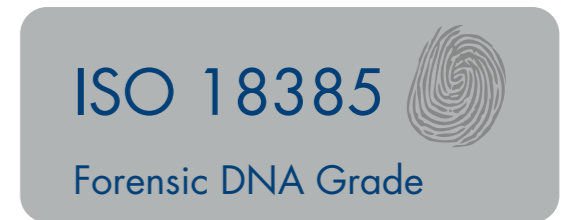


Figure 17. ISO 18385 Forensic DNA Grade. Investigator products that undergo an EO treatment are labeled accordingly.

With these measures, our entire Investigator product portfolio and corresponding manufacturing sites are ISO 18385 certified by external authorities and compliant with the ISO 18385 forensic manufacturing standard to minimize the risk of human DNA contamination in products used to collect, store and analyze biological material for forensic purposes.



Learn more about NGS for HID. Visit [www.qiagen.com/HIDandNGS](http://www.qiagen.com/HIDandNGS)



For more Forensic Grade quality, see [www.qiagen.com/forensicgrade](http://www.qiagen.com/forensicgrade).

## Ordering Information

Product	Contents	Cat. no.
<b>Sample collection</b>		
QIAcard FTA Elute Buffer	For improved recovery and integrity of nucleic acids from QIAcard FTA Elute formats 40 mL bottle for 200 preps of, e.g., 4 x 3 mm (Ø) punches	WB120100
QIAcard FTA Elute Micro (100)	100 cards for sample preservation and transport at room temperature. Designed for elution of nucleic acids in combination with the QIAcard FTA Elute Buffer	WB120410
Sterile Foam Applicators (100)	100 swabs for easy collection of buccal cells and saliva and transfer to e.g., QIAcard FTA card formats	WB100032
OmniSwab Sterile (100)	100 sterile collection swabs with ejectable brush-like head used for buccal and saliva samples	WB100035
4N6FLOQSwabs in peelpouch (100)	For 100 samples (also available in dry tube and active drying formats)	WB100100
EasiCollect Plus (50)	50 buccal sample collection devices: Includes a foam applicator for direct sample transfer to an integral QIAcard FTA Indicating.	WB120472
EasiCollect Buccal Collection Kit (50)	50 buccal sample collection kits: Includes EasiCollect (incl. barcode), return mailing envelop, multi-barrier pouch, nitrile gloves, tamper evident tape and desiccant	WB120237
UniCore Punch 1.2 mm*	Manual punch for precise sample disc removal from FTA cards	WB100028
Investigator STR GO! Lysis Buffer (200)	Lysis buffer for 200 swab samples	386516
Investigator STR GO! Punch Buffer (200)*	PCR additive for 200 samples to overcome inhibition from epithelial or blood cells on paper	386526
<b>Pretreatment</b>		
TissueLyser III	TissueLyser III instrument for sample disruption	9003240
Investigator Lyse&Spin Basket Kit (50)*	50 pouches with 50 baskets and 100 collection tubes	19597
Investigator Casework GO! Kit	Casework GO! Lysis Buffer, Proteinase K Solution and nuclease-free water	386546
<b>DNA purification and assay setup</b>		
QIAcube Connect	Instrument, connectivity package, 1-year warranty on parts and labor	9002864
Starter Pack, QIAcube	Reagent bottle racks (3), 200 µL filter-tips (1024), 1000 µL filter-tips (1024), 30 mL reagent bottles (12), rotor adapters (240), rotor adapter holder	990395
QIAamp DNA Investigator Kit (50)	For 50 DNA preps: 50 QIAamp MinElute Columns, Proteinase K, Carrier RNA, Buffers, Collection Tubes (2 mL)	56504

\* Larger kit sizes available; please inquire.

## Ordering Information

Product	Contents	Cat. no.
EZ2 Connect Fx System	Benchtop instrument for automated isolation of nucleic acids from up to 24 samples in parallel, using sealed prefilled cartridges; includes 2x EZ2 Connect racks and 1-year warranty on parts and labor	9003220
EZ1&2 DNA Investigator Kit (48)	For 48 preps: Reagent Cartridges (DNA Investigator), Disposable Filter-Tips, Disposable Tip-Holders, Sample Tubes (2 mL), Elution Tubes (1.5 mL), Buffer G2, Proteinase K, Carrier RNA	952034
EZ2 DNA Investigator Sep&Prep Kit (48)	For 48 preps: Reagent Cartridges (Investigator Sep&Prep), Disposable Filter-Tips and Tip-Holders, Tubes, QIAshredder, Buffers and Reagents	952134
QIASymphony SP	QIASymphony sample prep module, 1-year warranty on parts and labor	9001297
QIASymphony DNA Investigator Kit (192)	For 192 preps of 200 µL each from casework and reference samples: Includes 2 reagent cartridges and enzyme racks and accessories	931436
Investigator STAR Lyse&Prep Kit (400)	For 400 preps: Buffer ATL, Buffer QSL3, Buffer QSW1, Buffer QSW2, Bead Suspension G, Buffer ATE, Proteinase K, Carrier RNA, Q-Card, Handbook	931447
QIASymphony AS	QIASymphony assay set-up module, 1 year warranty on parts and labor	9001301
QIAgility System HEPA/UV (incl. PC)	Robotic workstation for automated PCR set-up (with UV light and HEPA filter); including notebook computer, QIAgility Software, installation and training, 1-year warranty on parts and labor	9001903
<b>Quantification</b>		
Investigator Quantiplex Pro Kit (200)	For use on Applied Biosystems Real-Time Systems: Reaction Mix, Primer Mix, Control DNA M1, QuantiTect® Nucleic Acid Dilution Buffer	387216
Investigator Quantiplex Pro RGQ Kit (200)	For use on QIAGEN RotorGene Q Real-Time Systems: Reaction Mix, Primer Mix, Control DNA M1, QuantiTect Nucleic Acid Dilution Buffer	387316
Investigator Quantiplex Pro FLX Kit (576)	For use on Applied Biosystems Real-Time Systems: 6x single blistered 96-well optical plates with Master Mix, Control DNA M1, QuantiTect Nucleic Acid Dilution Buffer	387516
Investigator Quantiplex Pro Calibration Kit	For use on Applied Biosystems Real-Time Systems: Calibration Standard FAM (60 µL), Calibration Standard JOE (60 µL), Calibration Standard ATTO 550 (60 µL), Calibration Standard ROX (60 µL), Calibration Standard ATTO 647N (60 µL), Quantiplex Pro Calibration Buffer (30 mL)	387416
Rotor-Gene Q 5plex HRM Platform	Real-time PCR cyclers and High Resolution Melt analyzer with 5 channels (green, yellow, orange, red, crimson) plus HRM channel, laptop computer, software, accessories, 1-year warranty on parts and labor, installation and training not included	9001532

## Ordering Information

Product	Contents	Cat. no.
<b>Investigator human identification kits</b>		
Investigator 24plex QS Kit (100)*	Primer Mix, Fast Reaction Mix 2.0, Control DNA, Allelic Ladder, DNA Size Standard, Nuclease-Free Water	382415
Investigator 24plex GO! Kit (200)*	Primer Mix, Fast Reaction Mix 2.0, Control DNA, Allelic Ladder, DNA Size Standard	382426
Investigator 26plex QS Kit (100)*	Primer Mix, Fast Reaction Mix 3.0, Control DNA, Allelic Ladder, Nuclease-Free Water	382615
Investigator ESSplex SE QS Kit (100)*	Primer Mix, Fast Reaction Mix 2.0, Control DNA, Allelic Ladder, DNA Size Standard, Nuclease-Free Water	381575
Investigator Triplex AFS QS Kit (400)	Primer Mix, Reaction Mix, DNA Polymerase, Control DNA, Allelic Ladder, DNA Size Standard, Nuclease-Free Water	380317
Investigator HDplex Kit (100)	Primer Mix, Reaction Mix, DNA Polymerase, Control DNA, Allelic Ladder, DNA Size Standard, Nuclease-Free Water	381215
Investigator Argus X-12 QS Kit (25)*	Primer Mix, Fast Reaction Mix 2.0, Control DNA, Allelic Ladder, DNA Size Standard, Nuclease-Free Water	383223
Investigator Argus Y-28 QS Kit (100)*	Primer Mix, Fast Reaction Mix 3.0, Control DNA, Allelic Ladder, DNA Size Standard, Nuclease-free Water	383625
<b>Next-generation sequencing instrument and kits</b>		
MiSeq FGx Sequencing System	Desktop instrument with two run modes for a range of forensic genomics applications within a validated NGS workflow	15048976
ForenSeq Universal Analysis Software (UAS), server and monitor	Software pre-installed as a dedicated server specific for forensic genomics for run setup, sample management, analysis and report generation	9003364
ForenSeq Signature Plus Kit (96)*	Includes all the required reagents to prepare sequencing libraries from forensic DNA samples; part of MiSeq FGx Forensic Genomics Solution	V16000213
ForenSeq MainstAY Kit (96)*	Includes all the required reagents for 96 reactions to prepare sequencing libraries generating data for mainstream casework and forensic genetic genealogy confirmatory testing	V16000142
ForenSeq MainstAY SE Kit	Includes all the required reagents for 96 reactions to prepare sequencing libraries generating data for mainstream casework and forensic genetic genealogy confirmatory testing including the same markers as in ForenSeq MainstAY Kit + SE33	V16000183
ForenSeq Imagen Kit	Includes the required reagents to process up to 96 samples simultaneously for phenotypic and biogeographical ancestry information to generate comprehensive DNA profiles	V16000189

\* Larger kit sizes available; please inquire.

## Ordering Information

Product	Contents	Cat. no.
ForenSeq mtDNA Control Region Kit	Includes all the primary reagents necessary for 48 reactions for the preparation of complete mtDNA control region libraries	V16000085
ForenSeq mtDNA Whole Genome Kit	Includes all the primary reagents necessary for 48 reactions for the preparation of complete whole mtDNA genome libraries	V16000086
ForenSeq Kintelligence Kit	Includes all the required reagents to prepare up to 12 low-quality forensic samples for forensic genetic genealogy	V16000120
ForenSeq Kintelligence HT Kit	Includes all the required reagents to prepare libraries from unidentified persons and remains samples with sequencing capabilities up to 12 postmortem libraries and 36 antemortem libraries	V16000190



Learn more about our human identity and forensic testing solutions for confidence in your evidence at [www.qiagen.com/human-id-solutions](https://www.qiagen.com/human-id-solutions)

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Investigator Kits meet ISO 18385 requirements.

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