



INFINITI[®] System Assay for Factor II
Directional Package Insert (DPI)

For *In Vitro* Diagnostic Use

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INTENDED USE

The INFINITI System Assay for Factor II is an *in vitro* diagnostic device that consists of reagents and instrumentation which includes polymerase chain reaction (PCR) primers, hybridization matrices, a thermal cycler, an imager, and software for detection and genotyping of Factor II (Prothrombin) G20210A point mutation in deoxyribonucleic acid (DNA) obtained from human blood samples. The INFINITI System Assay for Factor II is a qualitative assay for use in clinical laboratories upon prescription by the attending physician.

The INFINITI System Assay for detection and genotyping of Factor II is indicated for use as an aid to diagnosis in the evaluation of patients with suspected thrombophilia.

BACKGROUND-INFORMATION

Genetic risk factors are involved in the predisposition of individuals to venous thrombosis ^(1, 2). The most common mutation associated with inherited thrombosis is Factor V Leiden G1691A mutation and results in resistance to activated protein C. This mutation has a relatively high prevalence in the general population (about 5% in Caucasians), and accounts for 85% to 95% of activated protein C resistant cases.⁽²⁾ Factor V Leiden G1691A mutation renders an enhanced risk of venous thrombosis, with odds ratios (ORs) of 3 to 8 in heterozygotes and 30 to 140 in homozygotes ⁽³⁾.

The second most common mutation associated with hereditary thrombosis is the G20210A mutation in the prothrombin (Factor II) gene. This is associated with increased plasma prothrombin levels and is present in 1% to 2% of the general population ⁽²⁾. Heterozygote carriers of the prothrombin G20210A mutation have an estimated 3 to 8-fold increased risk for venous thrombosis. Homozygote carriers are very rare and information on the increased risk for thrombosis associated with the homozygous mutation is very limited.

Heterozygosity for both Factor V Leiden G1691A and Factor II (Prothrombin) G20210A mutations results in earlier onset of thrombosis and greater severity as compared to the presence of either mutation alone in the heterozygous state.

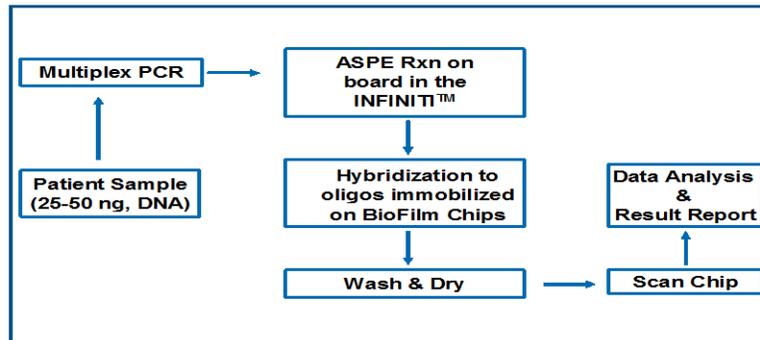
TEST PRINCIPLE/ASSAY OVERVIEW

The INFINITI System Assay for Factor II is designed to detect Factor II G20210A mutation. The assay protocol is based on five major processes:

- (a) DNA extraction from human blood samples
- (b) PCR amplification of purified DNA
- (c) Fluorescent label incorporation using analyte specific primer extension (ASPE)
- (d) Hybridization of the ASPE primers to a microarray followed by washing
- (e) Scanning of the microarray
- (f) Signal detection and analysis (determination of the Factor II genotype)

Steps (c) through (f) are automated by the INFINITI Analyzer or the INFINITI PLUS Analyzer.

A schematic overview of the assay is shown below.



DEVICE DESCRIPTION

The INFINITI System Assay for Factor II is an *in vitro* diagnostic device which utilizes AutoGenomics' proprietary film-based microarray technology combined with process automation, reagent management and software technology for the detection and genotyping of the Factor II (Prothrombin) G20210A mutation from DNA obtained from human whole peripheral blood samples.

The INFINITI System Assay for Factor II is comprised of the BioFilmChip[®] Microarray, the Intellipac[®] Reagent Module, and the INFINITI Analyzer with the Qmatic[®] Operating Software.

The **BioFilmChip Microarray** consists of a polyester film coated with proprietary multi-layer components designed for DNA analysis. The layers have been designed to provide a versatile surface to enhance test performance. The microarrays are designed to be assay specific. The INFINITI System Assay for Factor II uses a microarray chip (L-Chip) which contains unused Capture Probes which could potentially be used for certain specific assays. Therefore, multiple assays can be developed using the same microarray.

The **Intellipac Reagent Module** which acts as a communication link contains four reservoirs that house the test reagents and has an integrated memory chip. Reagent information such as lot number, expiration date, and volume usage are archived in the memory chip and appear on the worklist (run report).

The **INFINITI Analyzer** (including the modified version, **INFINITI PLUS Analyzer**) is an instrument used for clinical multiplex systems intended to measure and sort multiple signals from a clinical sample. The Analyzer is designed to measure fluorescence signals of labeled DNA target hybridized to BioFilmChip microarrays. The Analyzer automates the Factor II assay and integrates all the discrete processes of sample (PCR amplicon) handling, reagent management, hybridization, detection, and results analysis. The assays are processed automatically and the spots are read by the built-in confocal microscope. Results are analyzed and presented in numerical and graphical format.

The Analyzer has two main components: pipetting and optics modules. A variety of electronic components inside the instrument are used for its operation. These include multiple stepper motors, heating and cooling devices, a barcode reader, a photomultiplier tube, and a camera all connected to USB ports.

- Pipetting Module - The pipetting module performs all the operations related to dispensing and aspiration of reagent and processing the amplified sample to be dispensed on the microarray. When the sample has been



processed and hybridized to the microarray, it is transferred to the optics module for measurement of fluorescence signal.

- Optics Module - The optics module is a lightproof assembly comprised of a 3-axis stage; camera, lasers, a photo multiplier tube (PMT), and a camera. It is the enclosed casement into which the microarray is transported automatically prior to being processed on the stringency station. The optics' stage follows X-Y-Z motions that can be stepped at a very precise rate (2.0 micron per step). Using excitation wavelengths of a 760nm laser diode, the camera takes a 1.2x1.2mm picture for each registration spot of a fluorescent dye. Analyses of these pictures allow the location of three registration spots to be determined. With respect to the position of the three registration spots, coordinates of all the bio-spots can be located. While scanning, the stage moves along the Z-axis to focus the chip and the X and Y-axes to locate the individual spots on the microarray.

Instructions on how to use the Analyzers are provided in the Operator's Manuals.

The Analyzer's hardware is controlled by the **Qmatic® operating software**, which is installed with-in the on-board computer and utilizes a LCD screen display. The Analyzer's modules are controlled by multitasking real time software. The Qmatic operating software has a schedule manager that is capable of controlling all operations of the Analyzer such as assay protocol, fluid handling, robotics, optical detection and result analysis. Results are available for review via the LCD screen. Management reports include results in numerical and graphical format. The operator can also print the displayed results in tabular form (printer not included with the Analyzer).

WARNINGS AND PRECAUTIONS

Handling Requirements

- **For *in vitro* diagnostic use. To be used by qualified laboratory personnel.**
- This test is to be used only with whole blood collected in EDTA. Do not freeze/thaw blood samples. Specimens should be assayed as soon as possible.
- Do not use Heparin with this procedure; Heparin might interfere with the PCR.
- To minimize the risk of cross contamination, sample preparation, PCR reaction set up and PCR product analysis should be performed according to approved guidelines such as CLSI (Molecular Diagnostic Methods for Genetic Diseases: Approved Guideline).
- All patient specimens are potentially hazardous and care should be taken when handling materials of human origin. No test method can offer complete assurance that HCV, HIV or other infectious agents are absent.
Follow the CLSI Guidelines (Molecular Diagnostics Methods for Infectious Diseases; Approved Guidelines; MM3-A).
- Do not pool/mix reagents from different lots.
- Do not use a kit or reagent past its expiration date.
- Store kits and reagents according to the product label.

Laboratory Procedures

- Follow normal precautions for handling laboratory reagents. Do not mix reagents from different containers or from different lots.
- Follow safe laboratory procedures: do not pipette by mouth; wear protective clothing (e.g., disposable gloves laboratory coats) and eye protection; do not eat, drink or smoke in the laboratory work areas; wash hands thoroughly after handling samples and reagents.

Waste Handling

- Dispose of unused reagents, specimens and waste according to applicable country, federal, state and local regulations
- Safety data Sheets (SDS) are available upon request from AutoGenomics Customer Service

Sample Preparation

- Refer to the safety instructions in the package insert provided with the DNA extraction kit used.
- The PCR product cannot be stored prior to loading it onto the microarray. Use immediately.

INFINITI Analyzer and the INFINITI PLUS Analyzer

- **Read the Operator's Manuals before operating the instruments.** Pay particular attention to "Notes".
- Follow the Caution and Safety Warning in the Operator's Manual.
- Refer to the Installation Requirements Section when installing the instrument.
- Refer to the Errors Section when errors are encountered while operating the instrument.
- Refer to the Help Section when problems are encountered

STORAGE / STABILITY

BioFilmChip Microarray:	24 months Refrigerated (2°C to 8°C)
Intellipac Reagent:	12 months Refrigerated (2°C to 8°C)
	<i>Note:</i> Do not use after Intellipac has been opened for 4 weeks.
Amplification Mix:	18 months Frozen (-30°C to -15°C)

Note: Specific product expiration date is printed on the product label

SPECIMEN COLLECTION AND STABILITY

- Peripheral blood drawn in an EDTA (purple-top) tube.
- Do not freeze/thaw blood samples. Specimens should be assayed as soon as possible.

MATERIALS PROVIDED (EACH PACKAGE IS SUFFICIENT FOR 48 TESTS)

- AutoGenomics Product Number 01-1020-01: FII Magazine – BioFilmChip Microarray (with specific capture probes); 4 magazines per package
- AutoGenomics Product Number 01-2020-01: FII Intellipac Reagent Management Module: 24 tests per module; 2 modules per package. Each Intellipac module contains
 - 1.1 ml ASPE master mix composed of
 - d[AGT]TP Mix
 - Cy5 –dCTP
 - ASPE Primer Mix
 - Extension Buffer
 - 2.6ml Hybridization Buffer
 - SSC
 - Sodium Azide
 - Hybridization Positive Control (Pos C-PTAG10, Cy5)
- AutoGenomics Product Number 01-3020-01: FII Amp Mix. Each package contains: 4 x 250µl vials of AMP Mix and 1 x 30µl vial of Taq DNA Polymerase-1
 - AMP Mix contains
 - d[AGT]TP Mix
 - dCTP
 - PCR Primer Mix
 - MgCl₂
 - PCR Buffer
- : Product Number 12-0010-00: Wash buffer

REAGENTS REQUIRED BUT NOT PROVIDED BY AUTOGENOMICS



- DNA Extraction Kits - The INFINITI System Assay for Factor II can detect Factor II (Prothrombin) G20210A mutation using genomic DNA isolated from blood with sufficient purity, i.e., with the ratio of absorbance at 260nm to absorbance at 280nm of 1.7 to 2.0. Any DNA extraction method that meets this specification may be used. The INFINITI System Assay for Factor II has been tested with several commercially available kits and the user can contact AutoGenomics for further information.
- Distilled Water (DNAse and RNAse free)

EQUIPMENT

The following equipment is required but not provided with the assay reagents

- Pipettors
- Mini Centrifuge
- Pipette tips
- Microfuge tube Racks
- Thermocycler
- Vortex
- 0.2 ml thin wall tubes for PCR
- 1.5 ml microcentrifuge tubes
- 8-well Flat Strip Caps (Genesee Scientific, Catalog No. 22-623)
- AutoGenomics Product Number 11-0060-00: INFINITI Waste tray Stir Bars
- AutoGenomics Product Number 11-0020-00: INFINITI Waste Tray Liners
- AutoGenomics Product Number 11-0080-00: INFINITI Pipette Tips

- **FOR INFINITI Analyzer:**
 - AutoGenomics Product Number 10-0010-99: INFINITI Analyzer
 - AutoGenomics Product Number 11-0030-00: 24-Well Plates with Lids
 - AutoGenomics Product Number 11-0050-00: INFINITI Temp Cycle Plate

- **FOR INFINITI PLUS Analyzer:**
 - AutoGenomics Product Number 10-0020-99: INFINITI PLUS Analyzer
 - AutoGenomics Product Number 11-0100-00: 48-Well Plates
 - AutoGenomics Product Number 11-0110-00: 48 Well Plate Lid (reusable)

ASSAY PROCEDURE

DNA Extraction

Follow the instructions provided with the DNA extraction kit used.

DNA Controls

It is required that a known positive controls and a negative control should be included in each test run.

PCR Reaction

Note:

- Keep Taq DNA polymerase on ice.
- Completely thaw reagents at room temperature then immediately place on ice.
- Vortex the amplification mix tube for 2 to 5 seconds then centrifuge briefly to bring the contents to the bottom of the tube.
- To avoid contamination, a separate area is recommended for assembly of the PCR reaction. Decontaminate pipettes and all work surfaces with freshly prepared 10% bleach.

- Filter tips and gloves must be used when handling specimens and controls.
- The PCR product cannot be stored prior to testing. Use immediately.

Note:

- For the INFINTI Analyzer use the 24WP.
- For the INFINTI PLUS Analyzer use the 48WP.

1. Thaw and bring to room temperature the tube of Amp Mix and keep Taq DNA polymerase on ice.
2. Vortex the Amp Mix tube 2 to 5 sec to mix reagents and centrifuge briefly to bring the content to the bottom of the tubes. Include one negative control in every PCR reaction set up.

Amp Mix	17.75 μ l
Taq DNA Polymerase-1	0.25 μ l
Template DNA (25 ng/ μ l)	2.0 μ l
<hr/>	
Total	20.0 μ l

For the PCR negative control, add 1 μ l of DNase free water.

Note: Setting up the PCR reaction in the micro-well plate is recommended to minimize sample handling in subsequent steps.

3. Vortex tubes for 2 to 5 seconds to mix and then centrifuge briefly.
4. Place tubes in the thermocycler and cycle using the following conditions

Multiplex 2 Tm PCR Conditions

Step No.	Temperature $^{\circ}$ C	Time	No. of Cycles
1	95	4 minutes	
2	95	15 seconds	40
	56	15 seconds	
	72	15 seconds	
3	4	Hold	

Note: When an Eppendorf Mastercycler EP was used with the ramp rate set at 75%, the total cycling time was 1 hour and 9 minutes (\pm 5 min). If using other thermocycler models we recommend adjusting the ramp rate in order to obtain an equivalent total cycling time.

Sample Loading

- 1) Carefully remove the 8-well flat strip caps to avoid splashing.
- 2) Load the well plate in the appropriate orientation (with well A1 in the back left corner) into the Analyzer
 - **INFINTI Analyzer:** Load the assembled 24WP with the associated lid (Product No. 11-0030-00).
 - **INFINTI PLUS Analyzer:** Load the assembled 48WP with a clean 48WP lid (see instructions in the INFINTI PLUS Analyzer Operator's Manual) (Product No. 11-0110-00, reusable).



- 3) Load the following: assay specific magazines, Intellipac, INFINITI Static Free Pipette tips, and buffer.
 - **FOR INFINITI Analyzer:**
Wash Buffer should be placed in the INFINITI bottle holders. The Wash Buffer goes in the left holder (near the magazine).
 - **FOR INFINITI PLUS Analyzer:**
Follow the INFINITI PLUS Analyzer Operator's Manual for checking and replacing Wash buffer.

Operation of the Analyzers

Follow the instructions in the Operator's Manuals

INFINITI Analyzer Operator's Manual (Product No. EM-34000)

INFINITI PLUS Analyzer Operator's Manual (Product No. EM-34041)

QUALITY CONTROL

- Maintain calibration of thermocycler according to manufacturer's specifications.
- Maintain calibration of INFINITI or INFINITI PLUS Analyzer according to AutoGenomics' specifications.
- Maintain calibration of pipettes according to manufacturer's specifications.

LIMITATIONS

The results obtained from this method should be used and interpreted only in the context of the overall clinical diagnosis. AutoGenomics is not responsible for any clinical decisions that are taken.

The absence of the mutations detected by this Procedure is no guarantee that other mutations are not present. Presence of other mutations is possible and is not detected by this kit

INTERPRETATION OF RESULTS

Results from the INFINITI System Assay for Factor II are reported to the user as a genotype "call", indicating which genotype was detected in the sample, i.e., Wild Type, Homozygous, or Heterozygous for Factor II (Prothrombin) G20210A mutation. In addition to the genotype "call", the ratio and the signal (RFU) are provided for each analyte.

If the call is "Indeterminate", repeat the sample assay and refer to the Trouble Shooting section of the INFINITI Analyzer Operator's Manual.

If errors occur during the assay, "Test Error" message (e.g., "low DNA") is shown. An Error Log is generated which identifies the problem. Depending on the error message/problem, the assay may have to be repeated.

DISPOSAL

Waste materials for the INFINITI System Assay for Factor II & Factor V are common waste materials generated in clinical laboratories, and should be handled/disposed of in accordance with the policies/procedures in place in the clinical laboratory.

PERFORMANCE CHARACTERISTICS

Analytical Specificity

Studies related to specificity were conducted during assay development. PCR primer specificity was determined by amplicon size on a gel and sequencing the amplicon. ASP primer specificity was determined by the correct calls made by the assay using known genomic samples. Capture probe specificity was determined by hybridizing different oligos and demonstrating that correct oligo hybridizes to the known spot.

Analytical Sensitivity

Studies demonstrated that the INFINITI System Assay for Factor II can detect as low as 1ng DNA and as high as 300ng DNA. A minimum of 25ng DNA is recommended for this assay.

Percent Agreement

The results of the comparison studies conducted in three clinical sites comparing the INFINITI System Assay for Factor II to FDA cleared device (predicate) demonstrated

98.6% accuracy for Factor II as compared with predicate

The results of the comparison studies are summarized below.

Genotype	Number Tested	Number of Correct Calls on First Run	Number of Invalid Calls* on First Run	Agreement First Run	Number of Correct Calls including Repeat Run	Number of Invalid Calls* on Repeat Run	Agreement After Repeat Run
Factor II G20210A							
WT	146**	126	20	86.3%	144	2	98.6%
MUT	22**	22	0	100%	22	n/a	100%
HET	40	39	1	97.5%	39	1	97.5%
Overall	208	187	21	89.9%	205	3	98.6%

* No discordant results. Invalid results refer to “indeterminate” results.

**Samples tested were taken from suspected thrombophilia patients except:

- 15 of the 146 WT samples (negative for Factor II G20210A mutation) were from a known genomic WT sample which was split into 15 individual samples.
- 15 of 22 Factor II G20210A mutation samples were from a known genomic sample which was split into 15 individual samples.

Precision/Reproducibility – Assay

Chip-to-chip: Using the same sample and the same INFINITI Analyzer, the assay was run in five replicates using three BioFilmChip microarrays from one lot. The CVs using average triplicate spots for each mutation ranged from 9 – 12% for wild-type present calls. This was repeated two other times, each time using a different INFINITI Analyzer. All calls were 100% correct.

Lot-to-lot: Three lots of BioFilmChip microarray were tested using the same instrument four times, each time using a different sample. Two-way ANOVA on the RFU readings did not detect lot-to-lot difference on three of the four test runs ($p > 0.05$), and detected lot-to-lot difference on one test run ($0.05 > p > 0.01$). Genotype calls were 100% correct.



Day-to-day: Known genomic sample was assayed 12 times on each of three days using one instrument. The RFU signal %CV ranged from 1.35 to 14.87 on day1, 0.77 to 19.72 on day 2 and 0.41 to 21.2 on day 3. Genotype calls were 100% correct.

Precision/Reproducibility - Instrument

- One DNA sample was analyzed using three different INFINITI Analyzers and one lot of BioFilmChips, five times (five runs).

Intra-Instrument: The %CV using a single chip five times on a single instrument ranged from 0.9 to 28.3%CV. Genotype calls were 100% reproduced within each instrument

Inter-Instrument: The %CV using a single chip five times on each of three instruments ranged from 0.5% to 12%CV. All genotype calls were 100% correct and reproducible.

- Three instruments were tested on three different days using a Standard (non-assay) Microarray Chip. For each instrument tested, each capture probe spot on the Standard Microarray Chip was read 24 times, then averaged, and a %CV calculated for the spot. The following lists the ranges for the %CV for the three instruments tested.

Instrument	Ave %CV	%CV Range
1	4.03%	1.9-7.5%
2	3.99%	2.7-6.5%
3	3.24%	1.9-5.3%

Sample Carry-over

No carry-over was detected when a series of 300ng of a wild type sample (FV-WT; FII-WT) was followed by 10ng of a positive sample (FV-WT; FII-M), followed by 300ng of a heterozygous sample (FV-H; FII-H), followed by a “No Template Control” or water, was run six times.

Interference

Results of the interference studies demonstrate that there is no interference with the INFINITI System Assay for Factor II from 8mg/dL bilirubin, 70mg/dL cholesterol, and 1333v/dL heparin. No studies were conducted with oral anti-coagulants; therefore, no claims are made.

REFERENCES

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3. Salomon O. et al; Single and Combined Prothrombotic Factors in Patients With Idiopathic Venous Thromboembolism; Arteriosclerosis, Thrombosis, and Vascular Biology. 1999;19:511-518) © 1999 American Heart Association, Inc.