Primerdesign™Ltd

Human Immunodeficiency Virus type 1

pol gene region

genesig® Standard Kit

150 tests

G Ξ N Ξ S I G

Kits by Primerdesign

For general laboratory and research use only

G Ξ N Ξ S I G

Quantification of Human Immunodeficiency Virus type 1 genomes
genesig Standard kit handbook HB10.02.11
Published Date: 09/11/2018

1

Introduction to Human Immunodeficiency Virus type 1

Human immunodeficiency virus (commonly known as HIV, and formerly known as HTLV-III and lymphadenopathy-associated virus) is a retrovirus that is the cause of the disease known as AIDS (Acquired Immunodeficiency Syndrome), a syndrome where the immune system begins to fail, leading to many life-threatening opportunistic infections.

HIV is transmitted through direct contact of a mucous membrane with a bodily fluid containing HIV, such as blood, semen, vaginal fluid, preseminal fluid or breast milk. This transmission can come in the form of: penetrative (anal or vaginal) sex; oral sex; blood transfusion; contaminated needles; exchange between mother and infant during pregnancy, childbirth, or breastfeeding; or other exposure to one of the above bodily fluids.

Infection in humans is now pandemic. As of January 2006, the Joint United Nations Programme on HIV/AIDS (UNAIDS) and the World Health Organization (WHO) estimate that AIDS has killed more than 25 million people since it was first recognized on December 1, 1981, making it one of the most destructive pandemics in recorded history. In 2005 alone, AIDS claimed an estimated 2.4—3.3 million lives, of which more than 570,000 were children. [1] A third of these deaths are occurring in sub-Saharan Africa, retarding economic growth by destroying human capital. Current estimates state that HIV is set to infect 90 million people in Africa, resulting in a minimum estimate of 18 million orphans.[2] Antiretroviral treatment reduces both the mortality and the morbidity of HIV infection, but routine access to antiretroviral medication is not available in all countries.[3]

Two species of HIV infect humans: HIV-1 and HIV-2. HIV-1 is hypothesized to have originated in southern Cameroon after jumping from wild chimpanzees (Pan troglodytes troglodytes) to humans during the twentieth century. HIV-2 is hypothesized to have originated from the Sooty Mangabey (Cercocebus atys), an Old World monkey of Guinea-Bissau, Gabon, and Cameroon. HIV-1 is more virulent, more easily transmitted and is the cause of the majority of HIV infections globally, while HIV-2 is less easily transmitted and is largely confined to West Africa.

References
1: Joint United Nations Programme on HIV/AIDS (2006). "Overview of the global AIDS epidemic", 2006 Report on the global AIDS epidemic (PDF format). Retrieved on 2006-06-08.
2: Joint United Nations Programme on HIV/AIDS. AIDS epidemic update, 2005. (PDF format) Retrieved on 2006-02-28.
3: Palella, F. J. Jr, Delaney, K. M., Moorman, A. C., Loveless, M. O., Fuhrer, J., Satten, G. A., Aschman and D. J., Holmberg, S. D. (1998). "Declining morbidity and mortality among patients with advanced human immunodeficiency virus infection. HIV Outpatient Study Investigators". N. Engl. J. Med 338 (13): 853-860. PubMed.

Quantification of Human Immunodeficiency Virus type 1 genomes
genesig Standard kit handbook HB10.02.11
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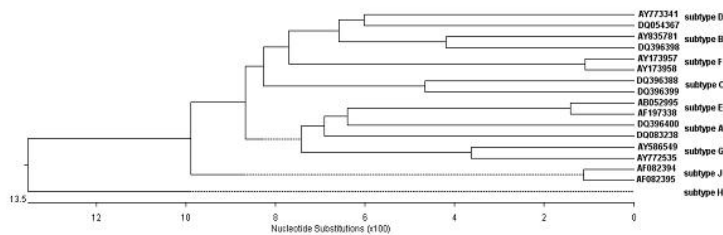
2

Specificity

The Primerdesign genesig Kit for Human Immunodeficiency Virus type 1 (HIV1) genomes is designed for the in vitro quantification of HIV1 genomes. The kit is designed to have a broad detection profile. Specifically, the primers represent 100% homology with over 95% of the NCBI database reference sequences available at the time of design.

The dynamics of genetic variation means that new sequence information may become available after the initial design. Primerdesign periodically reviews the detection profiles of our kits and when required releases new versions.

HIV-1 primers have been designed for the specific and exclusive in vitro quantification of all HIV-1 group M subtypes and does not detect groups N and O. The target sequence (pol) is highly conserved and has previously been shown to be a good genetic marker for HIV-1 detection in other real time PCR based studies (Tang N et.al 2007). The primers and probe sequences in this kit have 100% homology with over 95% of reference sequences contained in the NCBI database based on a comprehensive bioinformatics analysis. Representative sequences from each subtype are included in the polygenetic tree below.

If you require further information, or have a specific question about the detection profile of this kit then please send an e.mail to enquiry@primerdesign.co.uk and our bioinformatics team will answer your question.

Fig.1 Accession numbers for detected HIV-1 isolates

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Quantification of Human Immunodeficiency Virus type 1 genomes
genesig Standard kit handbook HB10.02.11
Published Date: 09/11/2018

3

Kit contents

- **HIV1 specific primer/probe mix (150 reactions BROWN)**
    FAM labelled

- **HIV1 positive control template (for Standard curve RED)**

- **RNase/DNase free water (WHITE)**
    for resuspension of primer/probe mixes

- **Template preparation buffer (YELLOW)**
    for resuspension of positive control template and standard curve preparation

Reagents and equipment to be supplied by the user

Real-time PCR Instrument

Extraction kit
This kit is recommended for use with genesig Easy DNA/RNA Extraction kit. However, it is designed to work well with all processes that yield high quality RNA and DNA with minimal PCR inhibitors.

oasig™ lyophilised OneStep or Precision®PLUS OneStep 2X RT-qPCR Master Mix
Contains complete OneStep RT-qPCR master mix

Pipettors and Tips

Vortex and centrifuge

Thin walled 1.5 ml PCR reaction tubes

GENESIG

Quantification of Human Immunodeficiency Virus type 1 genomes
genesig Standard kit handbook HB10.02.11
Published Date: 09/11/2018

4

Kit storage and stability

This kit is stable at room temperature but should be stored at -20ºC on arrival. Once the lyophilised components have been resuspended they should not be exposed to temperatures above -20°C for longer than 30 minutes at a time and unnecessary repeated freeze/thawing should be avoided. The kit is stable for six months from the date of resuspension under these circumstances.

If a standard curve dilution series is prepared this can be stored frozen for an extended period. If you see any degradation in this serial dilution a fresh standard curve can be prepared from the positive control.

Primerdesign does not recommend using the kit after the expiry date stated on the pack.

Suitable sample material

All kinds of sample material suited for PCR amplification can be used. Please ensure the samples are suitable in terms of purity, concentration, and RNA/DNA integrity. Always run at least one negative control with the samples. To prepare a negative-control, replace the template RNA sample with RNase/DNase free water.

Dynamic range of test

Under optimal PCR conditions genesig HIV1 detection kits have very high priming efficiencies of >95% and can detect less than 100 copies of target template.

Notices and disclaimers

This product is developed, designed and sold for research purposes only. It is not intended for human diagnostic or drug purposes or to be administered to humans unless clearly expressed for that purpose by the Food and Drug Administration in the USA or the appropriate regulatory authorities in the country of use. During the warranty period Primerdesign genesig detection kits allow precise and reproducible data recovery combined with excellent sensitivity. For data obtained by violation to the general GLP guidelines and the manufacturer's recommendations the right to claim under guarantee is expired. PCR is a proprietary technology covered by several US and foreign patents. These patents are owned by Roche Molecular Systems Inc. and have been sub-licensed by PE Corporation in certain fields. Depending on your specific application you may need a license from Roche or PE to practice PCR. Additional information on purchasing licenses to practice the PCR process may be obtained by contacting the Director of Licensing at Roche Molecular Systems, 1145 Atlantic Avenue, Alameda, CA 94501 or Applied Biosystems business group of the Applera Corporation, 850 Lincoln Centre Drive, Foster City, CA 94404. In addition, the 5' nuclease assay and other homogeneous amplification methods used in connection with the PCR process may be covered by U.S. Patents 5,210,015 and 5,487,972, owned by Roche Molecular Systems, Inc, and by U.S. Patent 5,538,848, owned by The Perkin-Elmer Corporation.

Trademarks

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Quantification of Human Immunodeficiency Virus type 1 genomes
genesig Standard kit handbook HB10.02.11
Published Date: 09/11/2018

5

Principles of the test

Real-time PCR

A HIV1 specific primer and probe mix is provided and this can be detected through the FAM channel.

The primer and probe mix provided exploits the so-called TaqMan® principle. During PCR amplification, forward and reverse primers hybridize to the HIV1 cDNA. A fluorogenic probe is included in the same reaction mixture which consists of a DNA probe labeled with a 5`-dye and a 3`-quencher. During PCR amplification, the probe is cleaved and the reporter dye and quencher are separated. The resulting increase in fluorescence can be detected on a range of qPCR platforms.

Positive control

For copy number determination and as a positive control for the PCR set up, the kit contains a positive control template. This can be used to generate a standard curve of HIV1 copy number / Cq value. Alternatively the positive control can be used at a single dilution where full quantitative analysis of the samples is not required. Each time the kit is used, at least one positive control reaction must be included in the run. A positive result indicates that the primers and probes for detecting the target HIV1 gene worked properly in that particular experimental scenario. If a negative result is obtained the test results are invalid and must be repeated. Care should be taken to ensure that the positive control does not contaminate any other kit component which would lead to false-positive results. This can be achieved by handling this component in a Post PCR environment. Care should also be taken to avoid cross-contamination of other samples when adding the positive control to the run. This can be avoided by sealing all other samples and negative controls before pipetting the positive control into the positive control well.

Negative control

To validate any positive findings a negative control reaction should be included every time the kit is used. For this reaction the RNase/DNase free water should be used instead of template. A negative result indicates that the reagents have not become contaminated while setting up the run.

Quantification of Human Immunodeficiency Virus type 1 genomes
genesig Standard kit handbook HB10.02.11
Published Date: 09/11/2018

6

Resuspension protocol

To minimize the risk of contamination with foreign DNA, we recommend that all pipetting be performed in a PCR clean environment. Ideally this would be a designated PCR lab or PCR cabinet. Filter tips are recommended for all pipetting steps.

1. **Pulse-spin each tube in a centrifuge before opening.**
   This will ensure lyophilised primer and probe mix is in the base of the tube and is not spilt upon opening the tube.

2. **Resuspend the kit components in the RNase/DNase free water supplied, according to the table below:**
   To ensure complete resuspension, vortex each tube thoroughly.

Component - resuspend in water	Volume
Pre-PCR pack	
HIV1 primer/probe mix (BROWN)	165 µl

3. **Resuspend the positive control template in the template preparation buffer supplied, according to the table below:**
   To ensure complete resuspension, vortex the tube thoroughly.

Component - resuspend in template preparation buffer	Volume
Post-PCR heat-sealed foil	
HIV1 Positive Control Template (RED) *	500 µl

* This component contains high copy number template and is a VERY significant contamination risk. It must be opened and handled in a separate laboratory environment, away from the other components.

GENESIG

Quantification of Human Immunodeficiency Virus type 1 genomes
genesig Standard kit handbook HB10.02.11
Published Date: 09/11/2018

7

OneStep RT-qPCR detection protocol

A OneStep approach combining the reverse transcription and amplification in a single closed tube is the preferred method. If, however, a two step approach is required see page 10.

For optimum performance and sensitivity.
All pipetting steps and experimental plate set up should be performed on ice. After the plate is poured proceed immediately to the OneStep amplification protocol. Prolonged incubation of reaction mixes at room temperature can lead to PCR artifacts that reduce the sensitivity of detection.

1. **For each RNA sample prepare a reaction mix according to the table below:**
   Include sufficient reactions for positive and negative controls.

Component	Volume
oasig OneStep or PrecisionPLUS OneStep 2X RT-qPCR Master Mix	10 µl
HIV1 primer/probe mix (BROWN)	1 µl
RNase/DNase free water (WHITE)	4 µl
Final Volume	**15 µl**

2. **Pipette 15µl of this mix into each well according to your qPCR experimental plate set up.**

3. **Pipette 5µl of RNA template into each well, according to your experimental plate set up.**
   For negative control wells use 5µl of RNase/DNase free water. The final volume in each well is 20µl.

4. **If a standard curve is included for quantitative analysis prepare a reaction mix according to the table below:**

Component	Volume
oasig OneStep or PrecisionPLUS OneStep 2X RT-qPCR Master Mix	10 µl
HIV1 primer/probe mix (BROWN)	1 µl
RNase/DNase free water (WHITE)	4 µl
Final Volume	**15 µl**

GENESIG

Quantification of Human Immunodeficiency Virus type 1 genomes
genesig Standard kit handbook HB10.02.11
Published Date: 09/11/2018

8

5. **Preparation of standard curve dilution series**

1) Pipette 90µl of template preparation buffer into 5 tubes and label 2-6
2) Pipette 10µl of Positive Control Template (RED) into tube 2
3) Vortex thoroughly
4) Change pipette tip and pipette 10µl from tube 2 into tube 3
5) Vortex thoroughly

Repeat steps 4 and 5 to complete the dilution series

Standard Curve	Copy Number *
Tube 1 Positive control (RED)	2×10^5 per µl
Tube 2	2×10^4 per µl
Tube 3	2×10^3 per µl
Tube 4	2×10^2 per µl
Tube 5	20 per µl
Tube 6	2 per µl

*The quantitative results produced by the genesig HIV1 kit can be converted to International Units by multiplying copy numbers by 64.2. This conversion factor was developed using RNA/DNA extracted (where applicable) from the WHO International Standard for HIV1.

Users of this kit are advised that the conversion factor serves as a guide. For the highest level of accuracy, it is best practice to calculate conversion factors independently using the WHO International Standard. If unsure, please contact your local sales representative for details regarding the generation of the conversion factor to ensure it is applied in the most appropriate fashion.

6. **Pipette 5µl of standard template into each well for the standard curve according to your plate set up**
The final volume in each well is 20µl.

OneStep RT-qPCR amplification protocol

Amplification conditions using oasig OneStep or PrecisionPLUS OneStep 2X RT-qPCR Master Mix.

	Step	Time	Temp
	Reverse Transcription	10 min	55 $^{\circ}$C
	Enzyme activation	2 min	95 $^{\circ}$C
Cycling x50	Denaturation	10 s	95 $^{\circ}$C
	DATA COLLECTION *	60 s	60 $^{\circ}$C

* Fluorogenic data should be collected during this step through the FAM channel

GENESIG Quantification of Human Immunodeficiency Virus type 1 genomes
genesig Standard kit handbook HB10.02.11
Published Date: 09/11/2018 9

Interpretation of results

Target	Positive control	Negative control	Interpretation
+	+	-	**POSITIVE QUANTITATIVE RESULT** calculate copy number
-	+	-	**NEGATIVE RESULT**
+ / -	+	≤ 35	**EXPERIMENT FAILED** due to test contamination
+ / -	+	> 35	*
+ / -	-	+ / -	**EXPERIMENT FAILED**

Positive control template (RED) is expected to amplify between Cq 16 and 23. Failure to satisfy this quality control criterion is a strong indication that the experiment has been compromised

*Where the test sample is positive and the negative control is positive with a Cq > 35, the sample must be reinterpreted based on the relative signal strength of the two results:

SAMPLE POSITIVE

$\Delta Cq > 5$

Sample   Negative control

INCONCLUSIVE

$\Delta Cq < 5$

Sample   Negative control
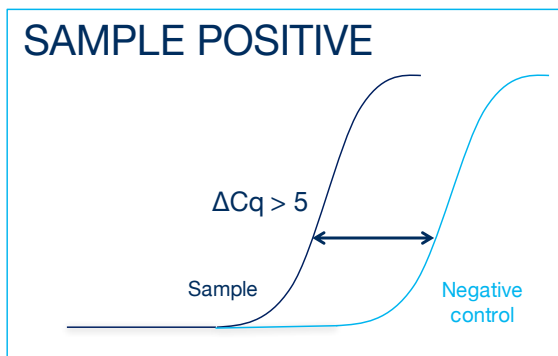
If the sample amplifies > 5 Cq earlier than the negative control then the sample should be reinterpreted (via the table above) with the negative control verified as negative.
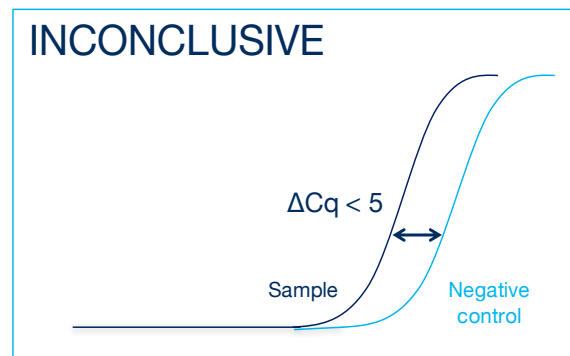
If the sample amplifies < 5 Cq earlier than the negative control then the positive sample result is invalidated and the result should be determined inconclusive due to test contamination. The test for this smaple should be repeated.

GENESIG
Quantification of Human Immunodeficiency Virus type 1 genomes
genesig Standard kit handbook HB10.02.11
Published Date: 09/11/2018
10