Techne® qPCR test

Human Rhinovirus 14

5’ non coding region (5’NCR)

150 tests

For general laboratory and research use only
Rhinovirus is a genus of the Picornaviridae family of viruses. Rhinoviruses are the most common viral infective agents in humans and are a causative agent of the common cold, being responsible for approximately 50% of all cases. Rhinoviruses have linear, single-stranded, positive-sense RNA genomes with that of HRV14 being 7212nt in length. At the 5’ end of the genome is a virus-encoded protein, and like mammalian mRNA, there is a 3’ poly-A tail. Structural proteins are encoded in the 5’ region of the genome and non-structural at the 3’ end. The viral particles themselves are not enveloped and are icosahedral in structure with a diameter of approximately 30nm.

Rhinoviruses are composed of a capsid that contains four viral proteins VP1, VP2, VP3 and VP4. VP1, VP2, and VP3 form the major part of the protein capsid. The much smaller VP4 protein has a more extended structure and lies at the interface between the capsid and the RNA genome. There are 60 copies of each of these proteins assembled as an icosahedron. Antibodies are a major defense against infection with the epitopes lying on the exterior regions of VP1-VP3.

Rhinoviruses have two main modes of transmission: direct transmission via inhalation of aerosolised respiratory droplets and indirect transmission via contact with surfaces contaminated with respiratory droplets. The viral capsid proteins bind to specific nasal cell receptors mediating entry into the host cell. Intracellular enzymes then digest the viral capsid leaving only the genome which functions as a template for the synthesis of the complementary strand. This encodes the viral capsid proteins for new viral particles as well as being packaged into these. The newly synthesised virus buds off from the host cell membrane facilitating infection of other cells.

Rhinoviruses occur worldwide causing disease with symptoms such as fever, cough, and nasal congestion which are the result of the immune system’s response to the virus. The frequency of colds is high in childhood and decreases during adulthood most probably because of the possession of immunity.

There are many HRV serotypes which, based on differences in their surface proteins and genome sequences have been segregated into two different groups: Human Rhinovirus A and B although some serotypes remain unclassified. HRV14 belongs to the HRVB species.
Specificity

The PrimerDesign™ Quantification Kit for human rhinovirus 14 has been designed for the specific and exclusive in vitro quantification of this subtype and does not detect other human rhinovirus strains. The primers and probe sequences in this kit have 100% homology with a broad range of clinically relevant reference sequences based on a comprehensive bioinformatics analysis.

The Techne® qPCR Kit for Human Rhinovirus 14 (HRV14) genomes is designed for the in vitro quantification of HRV14 genomes. The kit is designed to have the broadest detection profile possible whilst remaining specific to the HRV14 genome. The primers and probe sequences in this kit have 100% homology with a broad range of HRV14 sequences based on a comprehensive bioinformatics analysis.

If you require further information, or have a specific question about the detection profile of this kit then please send an e.mail to technehelp@bibby-scientific.com and our bioinformatics team will answer your question.
Kit Contents

- HRV14 specific primer/probe mix (150 reactions BROWN) FAM labelled
- HRV14 positive control template (for Standard curve RED)
- Internal extraction control primer/probe mix (150 reactions BROWN) VIC labelled as standard
- Internal extraction control RNA (150 reactions BLUE)
- Endogenous control primer/probe mix (150 reactions BROWN) FAM labelled
- HRV14/Internal extraction control/endogenous control RT primer mix (150 reactions GREEN)
  Required for two step protocol only
- RNAse/DNase free water (WHITE)
  for resuspension of primer/probe mixes and internal extraction control RNA
- 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

RNA extraction kit
  This kit is redesign to work well with all processes that yield high quality RNA with minimal PCR inhibitors.

Lyophilised OneStep 2x qRT-PCR MasterMix
  Contains complete one step qRT-PCR MasterMix

Pipettors and Tips

Vortex and centrifuge

1.5 ml tubes
Kit storage and stability
This kit is stable at room temperature but should be stored at -20°C on arrival. Techne does not recommend using the kit after the expiry date stated on the pack. Once the lyophilized components have been re-suspended, 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.

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 (An internal PCR control is supplied to test for non specific PCR inhibitors). 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 Techne HRV14 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 Techne® Prime Pro detection kits 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.

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Principles of the test

Real-time PCR
A HRV14 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 HRV14 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 real-time PCR 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 HRV14 copy number / CT 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 HRV14 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. If a positive result is obtained the results should be ignored and the test samples repeated. Possible sources of contamination should first be explored and removed.

Internal RNA extraction control
When performing RNA extraction, it is often advantageous to have an exogenous source of RNA template that is spiked into the lysis buffer. This control RNA is then co-purified with the sample RNA and can be detected as a positive control for the extraction process. Successful co-purification and real-time PCR for the control RNA also indicates that PCR inhibitors are not present at a high concentration.

A separate RT primer mix and a real-time PCR primer/probe mix are supplied with this kit to detect the exogenous RNA using real-time PCR. The PCR primers are present at PCR limiting concentrations which allows multiplexing with the target sequence primers. Amplification of the control cDNA does not interfere with detection of the HRV14 target cDNA even when present at low copy number. The Internal control is detected through the VIC channel and gives a CT value of 28+/-3 depending on the level of sample dilution.

Endogenous control
To confirm extraction of a valid biological template, a primer and probe mix is included to detect an endogenous gene. Detection of the endogenous control is through the FAM channel and it is NOT therefore possible to perform a multiplex with the HRV14 primers. A poor endogenous control signal may indicate that the sample did not contain sufficient biological material.

Carry-over prevention using UNG (unsuitable for onestep procedure and optional for two step procedure)
Carry over contamination between PCR reactions can be prevented by including uracil-N-
glycosylase (UNG) in the reaction mix. Some commercial mastermix preparations contain UNG or alternatively it can be added as a separate component. UNG can only prevent carry over from PCR reactions that include deoxyuridine triphosphate (dUTP) in the original PCR reaction. Techne recommend the application of 0.2U UNG per assay with a 15 minute incubation step at 37°C prior to amplification. The heat-labile UNG is then inactivated during the Taq polymerase activation step.
Reconstitution 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 split upon opening the tube.

2. Reconstitute 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

<table>
<thead>
<tr>
<th>Component</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-PCR pack</td>
<td></td>
</tr>
<tr>
<td>HRV14 primer/probe mix (BROWN)</td>
<td>165 µl</td>
</tr>
<tr>
<td>Internal extraction control primer/probe mix (BROWN)</td>
<td>165 µl</td>
</tr>
<tr>
<td>RT primer mix (GREEN)</td>
<td>165 µl</td>
</tr>
<tr>
<td>Endogenous control primer/probe mix (BROWN)</td>
<td>165 µl</td>
</tr>
<tr>
<td><strong>Pre-PCR heat-sealed foil</strong></td>
<td></td>
</tr>
<tr>
<td>Internal extraction control RNA (BLUE)</td>
<td>600 µl</td>
</tr>
</tbody>
</table>

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

### Component - resuspend in template preparation buffer

<table>
<thead>
<tr>
<th>Component</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Post-PCR heat-sealed foil</strong></td>
<td></td>
</tr>
<tr>
<td>Positive Control Template (RED) *</td>
<td>500 µl</td>
</tr>
</tbody>
</table>

* 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.

**RNA extraction**

The internal extraction control RNA can be added either to the RNA lysis/extraction buffer or to the RNA sample once it has been resuspended in lysis buffer.

**DO NOT** add the internal extraction control RNA directly to the unprocessed biological sample as this will lead to degradation and a loss in signal.

1. Add 4 µl of the Internal extraction control RNA (BLUE) to each sample in RNA lysis/extraction buffer per sample.

2. Complete RNA extraction according to the manufacturers protocols.
One Step RT-PCR detection protocol

A one step approach combining the reverse transcription and amplification in a single closed tube is the preferred method.

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 One Step 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.

<table>
<thead>
<tr>
<th>Component</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>OneStep 2x qRT-PCR MasterMix</td>
<td>10 µl</td>
</tr>
<tr>
<td>HRV14 primer/probe mix (BROWN)</td>
<td>1 µl</td>
</tr>
<tr>
<td>Internal extraction control primer/probe mix (BROWN)</td>
<td>1 µl</td>
</tr>
<tr>
<td>RNAse/DNAse free water (WHITE)</td>
<td>3 µl</td>
</tr>
<tr>
<td><strong>Final Volume</strong></td>
<td><strong>15 µl</strong></td>
</tr>
</tbody>
</table>

2. For each RNA sample prepare an endogenous control reaction according to the table below (optional): This control reaction will provide crucial information regarding the quality of the biological sample.

<table>
<thead>
<tr>
<th>Component</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>OneStep 2x qRT-PCR MasterMix</td>
<td>10 µl</td>
</tr>
<tr>
<td>Endogenous control primer/probe mix (BROWN)</td>
<td>1 µl</td>
</tr>
<tr>
<td>RNAse/DNAse free water (WHITE)</td>
<td>4 µl</td>
</tr>
<tr>
<td><strong>Final Volume</strong></td>
<td><strong>15 µl</strong></td>
</tr>
</tbody>
</table>

3. Pipette 15µl of these mixes into each well according to your real-time PCR experimental plate set up.

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>OneStep 2x qRT-PCR MasterMix</td>
<td>10 µl</td>
</tr>
<tr>
<td>HRV14 primer/probe mix (BROWN)</td>
<td>1 µl</td>
</tr>
<tr>
<td>RNAse/DNase free water (WHITE)</td>
<td>4 µl</td>
</tr>
<tr>
<td><strong>Final Volume</strong></td>
<td><strong>15 µl</strong></td>
</tr>
</tbody>
</table>

6. 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 10 µl from tube 2 into tube 3
5) Vortex thoroughly

Repeat steps 4 and 5 to complete the dilution series

<table>
<thead>
<tr>
<th>Standard Curve</th>
<th>Copy Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube 1 Positive control (RED)</td>
<td>2 x 10^5 per µl</td>
</tr>
<tr>
<td>Tube 2</td>
<td>2 x 10^4 per µl</td>
</tr>
<tr>
<td>Tube 3</td>
<td>2 x 10^3 per µl</td>
</tr>
<tr>
<td>Tube 4</td>
<td>2 x 10^2 per µl</td>
</tr>
<tr>
<td>Tube 5</td>
<td>20 per µl</td>
</tr>
<tr>
<td>Tube 6</td>
<td>2 per µl</td>
</tr>
</tbody>
</table>

7. 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.
# One Step Amplification Protocol
Amplification conditions using OneStep 2x RT-qPCR MasterMix.

<table>
<thead>
<tr>
<th>Step</th>
<th>Time</th>
<th>Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Transcription</td>
<td>10 mins</td>
<td>42 °C</td>
</tr>
<tr>
<td>Enzyme activation</td>
<td>2 mins</td>
<td>95 °C</td>
</tr>
<tr>
<td>Denaturation</td>
<td>10 secs</td>
<td>95 °C</td>
</tr>
<tr>
<td>**DATA COLLECTION *</td>
<td>60 secs</td>
<td>60 °C</td>
</tr>
</tbody>
</table>

* Fluorogenic data should be collected during this step through the FAM and VIC channels
## Interpretation of Results

<table>
<thead>
<tr>
<th>Target</th>
<th>Internal control</th>
<th>Negative control</th>
<th>Positive control</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ive</td>
<td>+ive</td>
<td>-ive</td>
<td>+ive</td>
<td>+ive</td>
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<tr>
<td>+ive</td>
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<tr>
<td>-ive</td>
<td>+ive</td>
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<td>+ive</td>
<td>-ive</td>
</tr>
<tr>
<td>-ive</td>
<td>-ive</td>
<td>-ive</td>
<td>-ive</td>
<td>Experiment fail</td>
</tr>
<tr>
<td>+ive</td>
<td>+ive</td>
<td>+ive</td>
<td>+ive</td>
<td>Experiment fail</td>
</tr>
</tbody>
</table>

### Internal PCR control
The CT value obtained with the internal control will vary significantly depending on the extraction efficiency, the quantity of RNA added to the RT and PCR reaction and the individual machine settings. CT values of $28 \pm 3$ are within the normal range. When amplifying a HRV14 sample with a high genome copy number, the internal extraction control may not produce an amplification plot. This does not invalidate the test and should be interpreted as a positive experimental result.

### Endogenous control
The signal obtained from the endogenous control primer and probe set will vary according to the amount of biological material present in a given sample. An early signal indicates the presence of a good yield of biological material. A late signal suggests that little biological material is present in the sample.