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EnviroTalks Webinar

WELCOME

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VIRSeek SARS-CoV-2 Coronavirus
Environment Testing Solutions

Katherine Campbell – Managing Director
Eurofins Technologies Australia
Dr Bob Symons – Regional Technical Manager
Eurofins Environment Testing Australia & New Zealand

3 June 2020

Acknowledgement of Country

We acknowledge the Traditional Owners of the country on which we meet today, and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past, present and emerging.

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Katherine Campbell

Katherine Campbell is the Managing Director of Eurofins Technologies Australia & New Zealand. Building on the experience and scientific excellence of the Eurofins Group, Eurofins Technologies is a fast growing provider of diagnostic technologies and industry-leading ELISA-based instruments in the field of Food&Feed Safety and Environmental Safety.

Katherine is originally from New Zealand and now living in Australia. Katherine has spent the last 12 years specialising in the field of diagnostic testing technology, ranging from rapid HACCP tools through to advanced molecular diagnostic testing technology. Katherine has built substantial global distribution networks, provides ongoing comprehensive technical support and has collaborated with a range of customers in specialised industries within the environmental, food and feed space. It is with this experience and the specific knowledge of the VIRSeek SARS-CoV-2 testing technology that she is contributing to this webinar.

Dr Bob Symons

Bob Symons is the Regional Technical Manager for Eurofins Environment Testing in Australia & New Zealand and is based in their Sydney laboratory. Bob has a PhD in analytical chemistry from La Trobe University and has been working in the area of environmental organic chemistry for over 35 years employed by Australian State and New Zealand government laboratories as well as multi-national corporations. Bob's interests over the past 20 years have been the analysis of persistent organic pollutants (POPs) such as dioxins, PCBs, polybrominated diphenyl ethers (PBDEs) & other brominated flame retardants; per- and polyfluoro alkyl substances (PFAS), and more recently pharmaceutical and personal care products (PPCPs) using advanced mass spectrometric techniques. Bob is leading Eurofins establishment of an emerging contaminants laboratory specialising in the determination of "unknown unknowns" as well as the first commercial facility in Australia analysing microplastics, and now has an interest in the detection of SARS-CoV-2 in environmental surfaces, air, and wastewater.

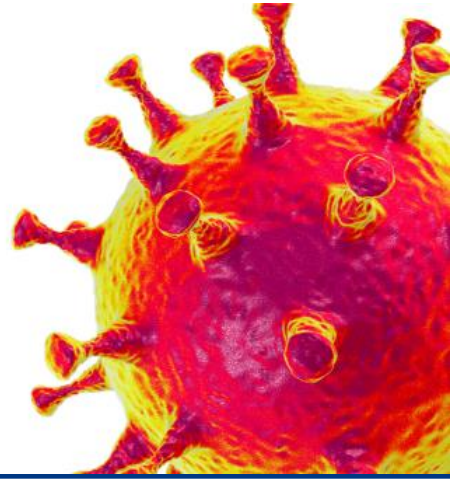
AUDIENCE PARTICIPATION ENCOURAGED

- Ask Questions using the ? at the RHS pane
- Q&A will be at the end of the presentation
- Recording link and slides will be shared

- NOTE: All participants will be muted from the beginning

Agenda

- Introduction to Eurofins
- Background Information
- Environmental Monitoring Programs
- Testing Protocols
- Challenges
- VIR*Seek* Solution for SARS-CoV-2
- Laboratory Analytical Solution
- Summary



Introduction to Eurofins

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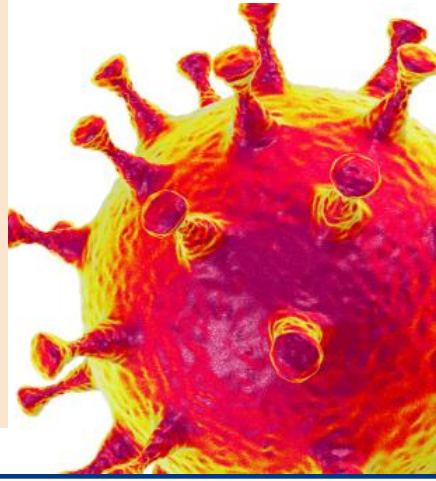
Eurofins – a leading international life sciences company which provides a unique range of analytical testing services to the pharmaceutical, food, environment and consumer products industries and to governments

Eurofins | Environment Testing – Est in 1974 with NATA Accredited Laboratories in Sydney, Melbourne (Head Office), Perth & Brisbane and Auckland & Christchurch with over 200 staff

Eurofins GeneScan Technologies (Freiburg, Germany) – specialised in the production of real-time PCR and ELISA kits and their application for environment and the food & feed testing industry

Eurofins Technologies – internationally-spread, fast growing provider of diagnostic technologies solutions for a wide range of product categories - GMO, Allergens, Animal Species, Mycotoxins, Pathogens, Pesticides, Cyanobacteria



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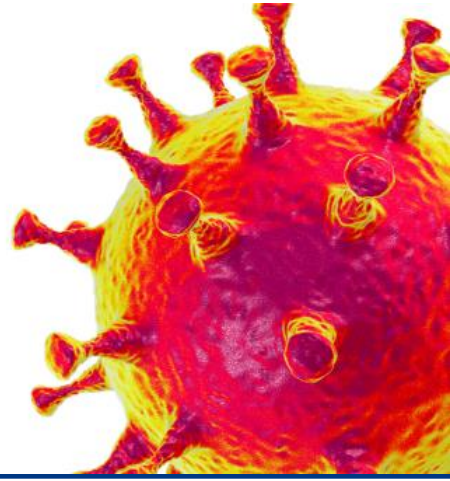


Role of SARS-CoV-2

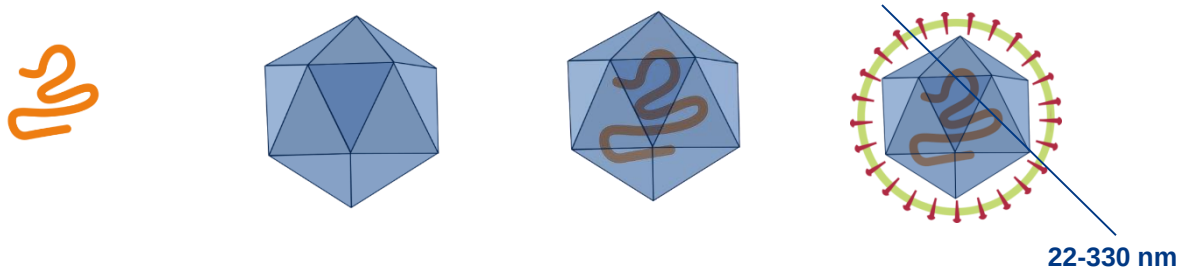
- **Coronavirus:** Family of enveloped RNA viruses
- **SARS:** severe acute respiratory syndrome
- **SARS-CoV-2:** severe acute respiratory syndrome coronavirus 2
- **COVID-19:** coronavirus disease caused by SARS-CoV-2 in 2019
  - **First outbreak:** December 2019 in Wuhan, Hubei Province, China
  - **WHO announces pandemic:** 11 March 2020
- **Main route of transmission / infection:**
  - Direct - Person to Person via droplets
  - Postulated Indirect - Touching of inanimate surfaces?

Draft version, April 2020 : Stability of SARS-CoV-2 and other coronaviruses in the environment and on 1 common touch surfaces. Hamada A. Aboubakr,Tamer Sharafeldin and Sagar M. Goyal

Structure + Size of Viruses

Coronavirus: Family of enveloped RNA viruses

Viral nucleic acid	Capsid	Nucleocapsid	Enveloped virus
dsDNA, ssDNA dsRNA, +ssRNA, -ssRNA circular, fragmented …	empty virus-like particles	capsid containing viral nucleic acid	capsid surrounded by an envelope made up of phospholipids and proteins
infectious	non-infectious	infectious	infectious
		Norovirus, HAV, HEV	Influenza, HIV, SARS CoV-2



SARS-CoV-2 on Surfaces?

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Low to no evidence of the role of food or environmental surfaces in the transmission of SARS-CoV-2

*"It may be possible that a person can get COVID-19 by **touching a surface or object** that has the virus on it and then touching their mouth, nose, or possibly their eyes, but this is not thought to be the main way the virus spreads."*

USA, FDA, 23.03.2020

*'These droplets can land on **objects and surfaces** around the person such as tables, doorknobs and handrails. People can become infected by touching these objects or surfaces, then touching their eyes, nose or mouth.'*

WHO, Q&A, 17.04.2020

➔ **Ongoing data generation will allow the evaluation of the role of inanimate surfaces in transmission**

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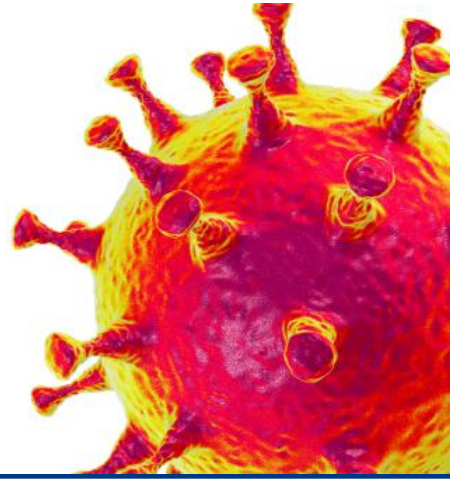
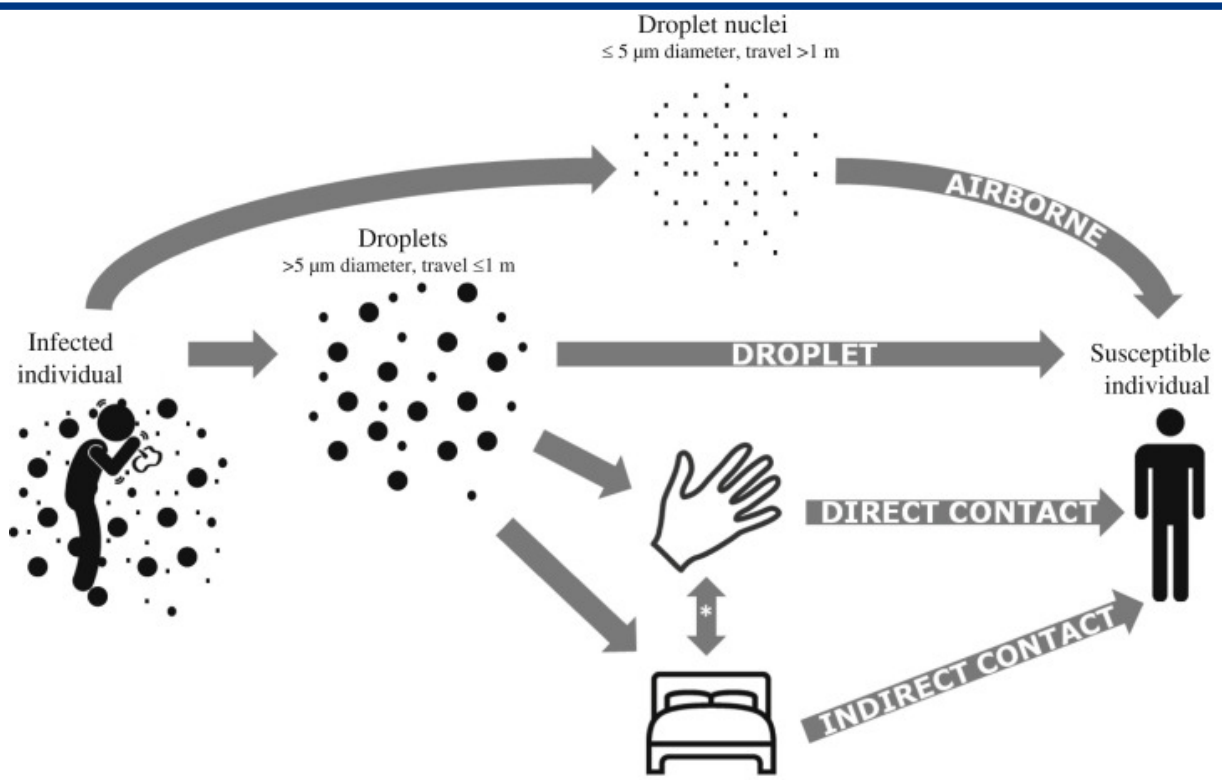


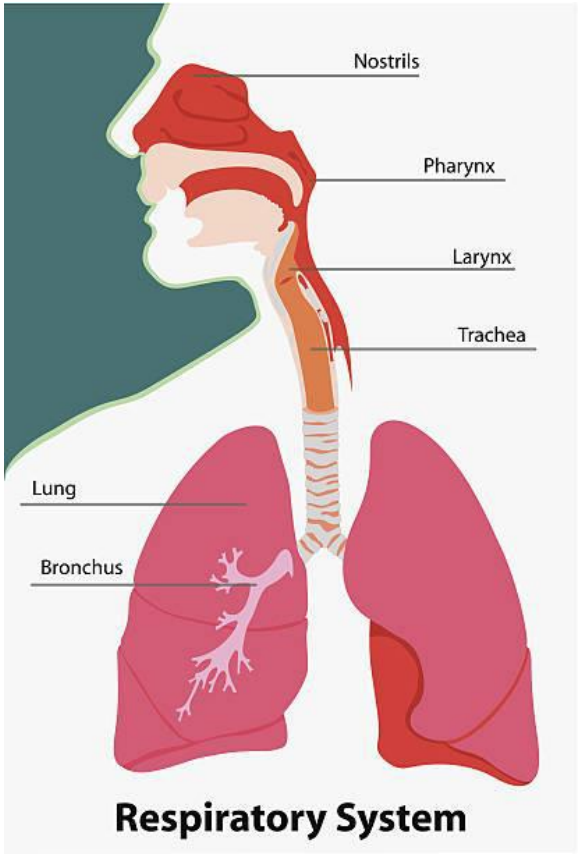
Transmission Routes



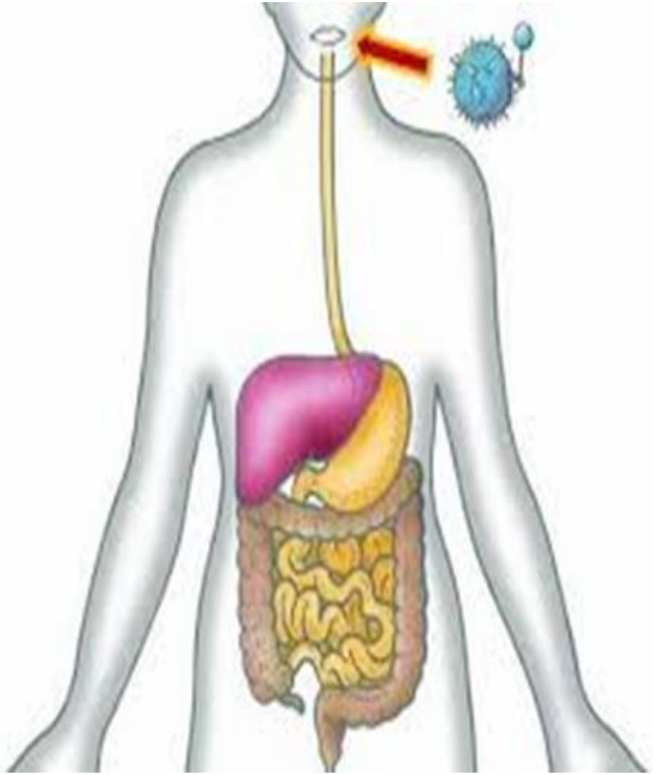
* Transmission routes involving a combination of hand & surface = indirect contact.

J.A. Otter et al. / Journal of Hospital Infection 92 (2016) 235e250

Transmission Routes



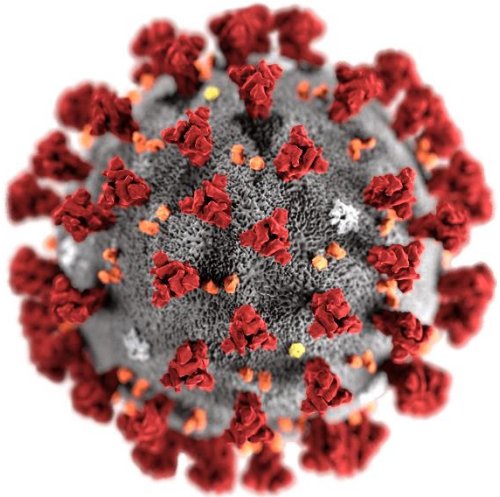
Respiratory System



Faecal-Oral Route

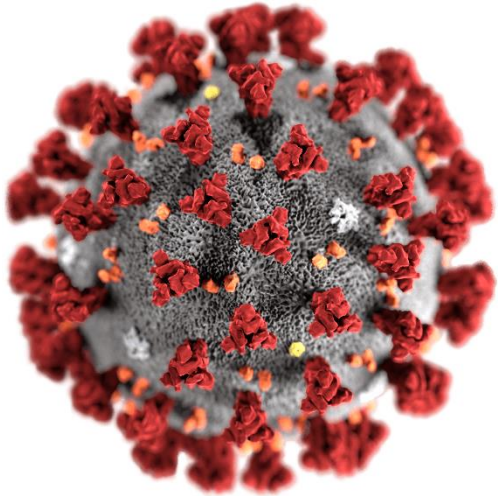
Fomite Spread

- A fomite or fomes is any inanimate object that, when contaminated with or exposed to infectious agents, can transfer disease to a new host
- In the 21st century, the role of fomites in disease transfer is higher than ever in human history because of the indoor lifestyle
- Can involve viruses that spread primarily by respiratory, body fluid/tissue spread or faecal oral
- Super shedders/spreaders asymptomatic individuals who expel much larger quantities of virus than the sick or dying
- Controlled by proper personal hygienic practices
- Controlled by proper disinfection



Coronavirus SARS-CoV-2

- Low to no evidence of the role of food or environmental surfaces in the transmission of SARS-CoV-2
- “It may be possible that a person can get COVID 19 by touching a surface or object that has the virus on it and then touching their mouth, nose, or possibly their eyes, but this is not thought to be the main way the virus spreads’’
- Initial scientific data shows viable virus detected up to 72 h on stainless steel and plastic surfaces (letter to the editor, March 17, 2020, at NEJM.org)
- Guideline published by WHO on surface sampling of SARS-CoV-2 (02/20)



SARS-CoV-2 on Surfaces?

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Initial scientific data on the retained infectivity of SARS-CoV-2 on surfaces shows:

Plastic	Metal	Glass, Rubber, Ceramic	Cardboard	Paper	Surgical Face Masks
3-4 days	3-4 days	2 days	1 day	30 min decay in 3 hours	4-7 days, higher on porous surfaces vs money (1 day)

Why Monitor Your Environment?

- Virus can spread by asymptomatic or pre-symptomatic individuals
- Combination of longevity of the virus on surfaces and the risk potential to have contaminated surfaces even in the absence of symptomatic individuals highlights importance of environmental monitoring for virus detection

WHERE TO SAMPLE? Examples of Recommended Sampling Sites

Potential SARS-Cov-2 Transmission Areas	High Risk Sampling Sites	Medium/Low Risk Sampling Sites
Company parking garage & parking lots	Guard gate ticket button, elevator button, stairway doors and knobs, stairway hand railing	Elevator walls, stairwell walls, floors
Company lobby & waiting room	Door knobs, light switches, countertops, sign-in sheet or touch screen, pens, chairs and arm rests, TV remote, end tables	Walls, literature, floors
Office spaces	Door knobs, light switches, desktops, tabletops, chairs and arm rests, keyboards, mice, phones, headsets	Walls, literature, floors
Production Facility	Door knobs, light switches, equipment buttons/dials, benchtops, tabletops, keyboards, mice, phones, conveyor belts, handrails (in walkways), maintenance tools, forklift steering wheels, faucet handles, towel dispensers, soap dispensers, cleaning tools (broom handles, squeegees, mops etc)	Walls, floors
Break rooms/canteens	Door knobs, light switches, countertops, cabinet knobs, drawer knobs, tabletops&benches, faucet handles, towel dispensers, soap dispensers, microwaves, oven door handles, refrigerator doors&handles, vending machines, waste bin lids	Walls, floors
Restrooms & lockers, locker rooms	Door knobs, light switches, faucet handles, towel dispensers, soap dispensers, restroom stall doors and handles, locker doors, toilet handles, waste bin lids, feminine napkins dispensers and waste bins	Walls, floors

List N: Disinfectants for Use Against SARS-CoV-2

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List N: Products with Emerging Viral Pathogens AND Human Coronavirus claims for use against SARS-CoV-2
Date Accessed: 06/02/2020

EPA Registration Number	Active Ingredient(s)	Product Name	Company	Follow the disinfection directions and preparation for the following virus	Contact Time (in minutes)	Formulation Type	Surface Type	Use Site	Emerging Viral Pathogen Claim?	Date Added to List N
1839-167	Quaternary ammonium	BTC 885 Neutral Disinfectant Cleaner-256	Stepan Company	Rotavirus	10	Dilutable	Hard Nonporous (HN)	Healthcare; Institutional; Residential	Yes	05/28/2020
93908-1	Hypochlorous acid	Envirolyte O & G	Aqua Engineered Solution Inc	Norovirus	10	RTU	Hard Nonporous (HN); Food Contact Post-Rinse Required (FCR)	Healthcare; Institutional; Residential	Yes	05/28/2020
1677-193	Peroxyacetic acid (Peracetic acid); Hydrogen peroxide	AdvaCare 120 Sanitizer/Sour	Ecolab Inc	Clostridioides difficile	6	Dilutable	Porous (P) (laundry)	Healthcare; Institutional	Yes	05/28/2020
12120-4	Peroxyacetic acid (Peracetic acid); Hydrogen peroxide	SSS Synersys Sporicidal Disinfectant	Standardized Sanitation Systems Inc	Norovirus	2	Dilutable	Hard Nonporous (HN); Food Contact Post-Rinse Required (FCR)	Healthcare; Institutional	Yes	05/28/2020
71355-1	Quaternary ammonium; Glutaraldehyde	Virocid	CID Lines NV	Porcine circovirus	10	Dilutable	Hard Nonporous (HN)	Institutional	Yes	05/28/2020
1839-168	Quaternary ammonium	BTC 885 NDC-32	Stepan Company	Rotavirus	10	Dilutable	Hard Nonporous (HN); Food Contact Post-Rinse	Healthcare; Institutional; Residential	Yes	05/28/2020

EPA United States Environmental Protection Agency

EPA approved active Ingredients: https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2

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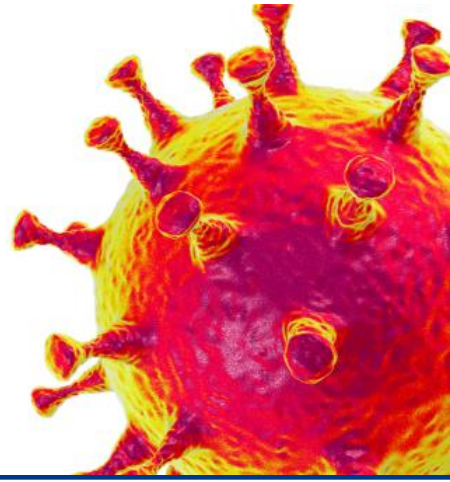

Eurofins Solutions to Fight the Global COVID-19 Pandemic

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Viral Sequencing:

- SARS-CoV-2 full-length genome next generation sequencing (NGS) service enabling end-to-end surveillance of the coronavirus genome sequence and mutational drift

Serological Testing:

- ELISA testing kits for serology-based antibody detection of patients that have been exposed to COVID-19 ELISA and CLIA-based serology testing services

Nucleic Acid Amplification Tests (NAAT):

- RT-PCR clinical testing services for the qualitative detection of SARS-CoV-2 VIR*Seek* solution kits

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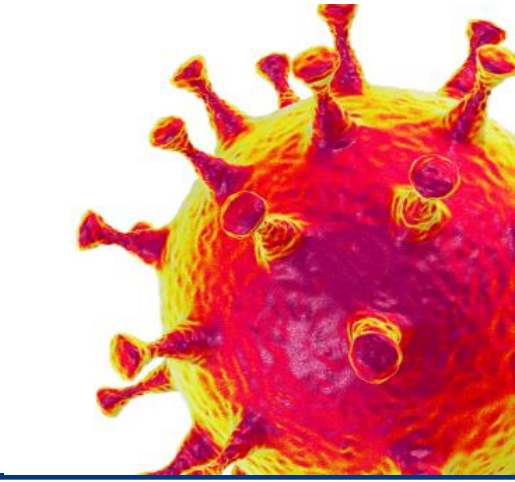

Detection of RNA Viruses

Challenges are at different levels:

- Virus extraction
- RNA extraction
- Virus detection

Analysis of RNA viruses faces challenges and there are not a lot of analytical tools to address this need.

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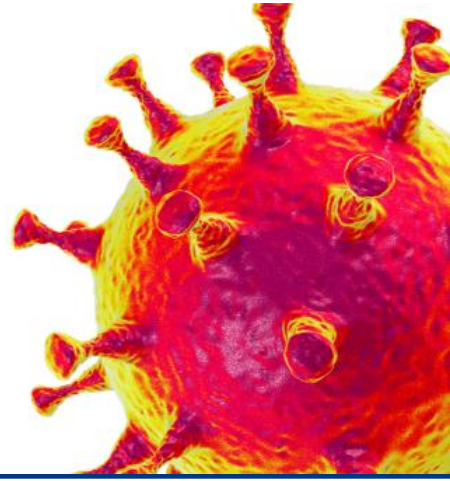
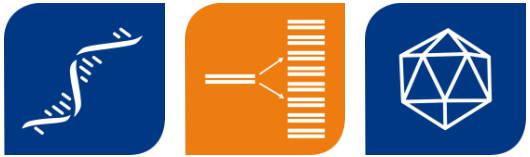


VIRSeek Workflow Outline

World Health Organization

- Virus sampling in accordance with ISO and WHO guidelines
- The use of a process control virus to evaluate RNA extraction efficiency
- RNA-isolation using magnetic silica-based beads enabling automation
- Subsequent analysis of the target virus using sensitive Real-Time RT-PCR technology

VIRSeek Solution



VIR*Seek* RNA*Extractor*

- Extraction of virus, preparation for real-time RT-PCR
- RNA extraction from viral samples acc. to ISO 15216 using enveloped and non-enveloped viruses
- Silica-coated magnetic bead based extraction
- Removal of potential inhibitors
- Sample types include:
  - Soft fruits
  - Leaf, stem and bulb vegetables
  - Bottled water
  - Bivalve molluscs
  - Environmental & Food surfaces

Global SARS-CoV-2 Testing

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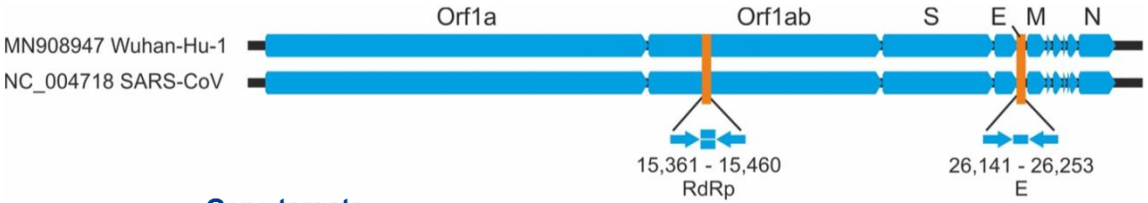
WHO recommendation to test for two target genes on the SARS-CoV-2 virus genome

- So far assays published mainly targeting
  - Orf1ab region (coding for RNA-dependent RNA polymerase, RdRP)
  - E-gen (coding for the envelope)
  - or the N-gens (coding for the nucleocapsid)



Country	Institute	Gene targets
China	China CDC	ORF1ab and N
Germany	Charité	RdRP, E, (N)
Thailand	National Institute of Health	N
US	US CDC	Three targets in N gene
France	Institut Pasteur, Paris	Two targets in RdRP

Global SARS-CoV-2 Testing

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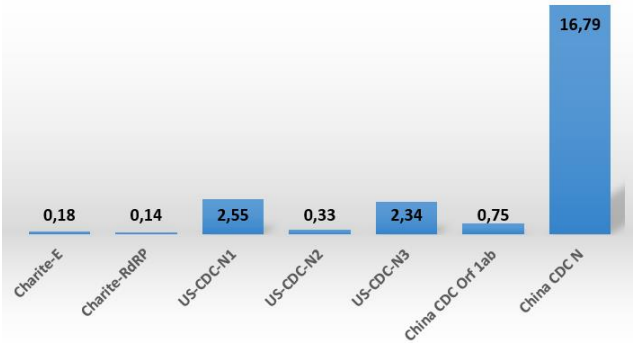
GISAID – open access database

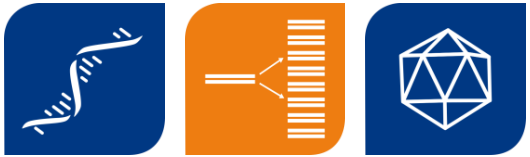
- App. 7500 genome of high-quality (out of 11 k) analysed
  - Overview percent genome with one/or more mutations in either forward/reverse-primer/probes
  - This does not necessarly indicate non-functionality

Percent of genomes with mutation in primer regions



GISAID

VIR*Seek*: RT-PCR



VIR*Seek* SARS-CoV-2 Screen & Ident

- One-step real-time RT-PCR is used to detect the RNA of the viruses

First line of testing by using VIR*Seek* SARS-CoV-2 Screen

- Detecting presence of SARS-CoV-2 E-gene
- Including an internal positive control (IPC) RNA as inhibition control

Second confirmatory assay by using VIR*Seek* SARS-CoV-2 Ident

- Detecting presence of SARS-CoV-2 RdRP-gene
- To be used in conjunction with:
  - VIR*Seek* SARS-CoV-2 Screen or
  - VIR*Seek* Murine Norovirus Process Control

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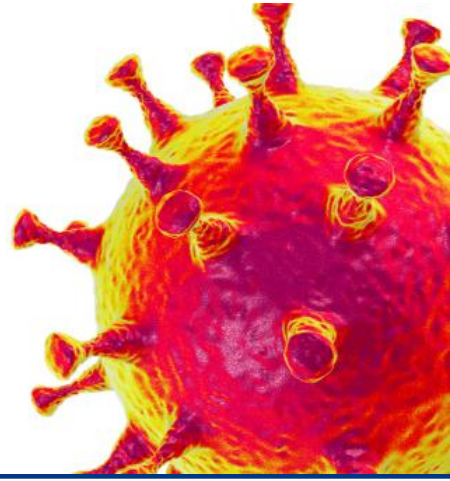
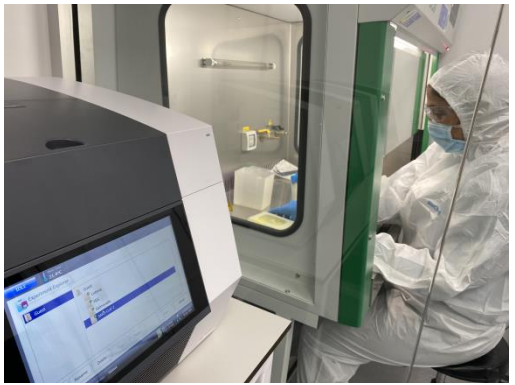


Analytical Services Solution

- Monitor the presence of environmental SARS-CoV-2 using
  - **VIR*Seek* SARS-CoV-2 Screen**
  - **VIR*Seek* SARS-CoV-2 Ident**
- Control samples to be taken according to WHO guidelines
- Specimens for virus detection should reach the laboratory as soon as possible after collection and should be stored at 2 - 8ºC
- Analysis must be conducted within 72 hours but 48 hours is highly recommended
- Shipping must be sent in designated coolers and kept separate from normal environmental samples
- Turn around time (TAT) - 24hrs
- Same day rush service available if delivered am



Kits Available

Plastic Bag containing
- Sterile Swab
- PBS (Phosphate-buffered Saline) diluent
- Sampling Instructions

Analysis can only be conducted on supplied swabs that are received in the laboratory intact

Samples are analysed as received

Analytical Services Solution

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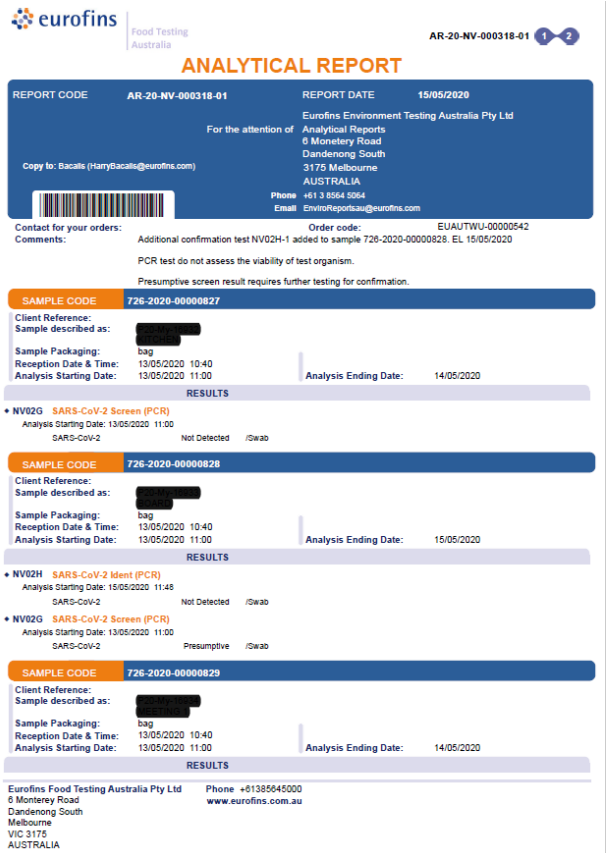
Results

- PCR test do not assess the viability of test organism
- Presumptive screen result requires further testing for confirmation
- SARS-CoV-2 Screen
  - Detected/Not detected
- SARS-CoV-2 Ident
  - Detected/Not detected
- NATA Accreditation - pending
- TAT - next day



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AR-20-NV-000318-01 1 2

ANALYTICAL REPORT

REPORT CODE AR-20-NV-000318-01 REPORT DATE 15/05/2020

For the attention of: Eurofins Environment Testing Australia Pty Ltd, Analytical Reports, 6 Monetery Road, Dandenong South, 3175 Melbourne, AUSTRALIA

Copy to: Bacalis (HarryBacalis@eurofins.com)

Phone +61 3 8564 5064

Email EnviroReportsau@eurofins.com

Contact for your orders: Order code: EUAUTWU-00000542

Comments: Additional confirmation test NV02H-1 added to sample 726-2020-00000828. EL 15/05/2020

PCR test do not assess the viability of test organism.

Presumptive screen result requires further testing for confirmation.

SAMPLE CODE 726-2020-00000827

Client Reference:
Sample described as: [redacted]
Sample Packaging: bag
Reception Date & Time: 13/05/2020 10:40
Analysis Starting Date: 13/05/2020 11:00
Analysis Ending Date: 14/05/2020

RESULTS

• NV02G SARS-CoV-2 Screen (PCR)
Analysis Starting Date: 13/05/2020 11:00
SARS-CoV-2 Not Detected /Swab

SAMPLE CODE 726-2020-00000828

Client Reference:
Sample described as: [redacted]
Sample Packaging: bag
Reception Date & Time: 13/05/2020 10:40
Analysis Starting Date: 13/05/2020 11:00
Analysis Ending Date: 15/05/2020

RESULTS

• NV02H SARS-CoV-2 Ident (PCR)
Analysis Starting Date: 15/05/2020 11:48
SARS-CoV-2 Not Detected /Swab

• NV02G SARS-CoV-2 Screen (PCR)
Analysis Starting Date: 13/05/2020 11:00
SARS-CoV-2 Presumptive /Swab

SAMPLE CODE 726-2020-00000829

Client Reference:
Sample described as: [redacted]
Sample Packaging: bag
Reception Date & Time: 13/05/2020 10:40
Analysis Starting Date: 13/05/2020 11:00
Analysis Ending Date: 14/05/2020

RESULTS

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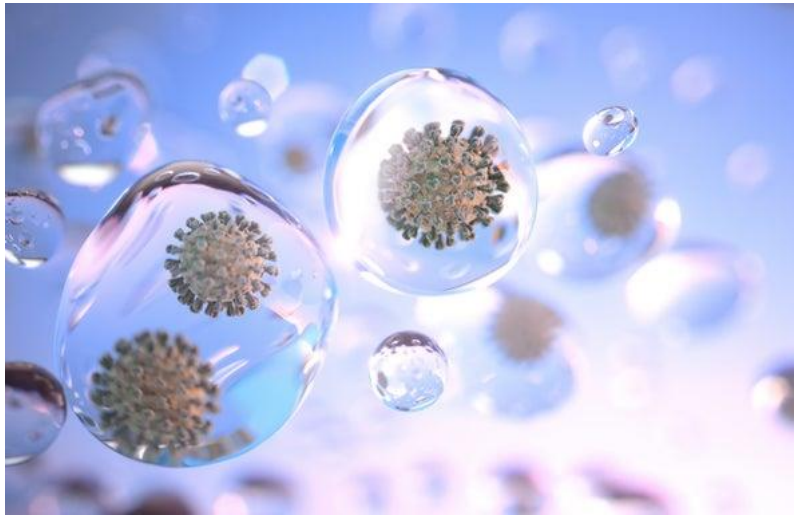
Association of Official Analytical Collaboration (AOAC) International

AOAC INTERNATIONAL activates accelerated program to evaluate test kits for detecting coronavirus on surfaces

Emergency Response Validation Project will streamline expert review of SARS-CoV-2 Virus Test Kits

Rockville, Maryland, May 18, 2020—AOAC INTERNATIONAL today announced the launch of a project to evaluate and certify the performance of test kits that detect the SARS-CoV-2 coronavirus, the causative agent of COVID-19 illness, on environmental surfaces.

The project will employ the Emergency Response Validation option of the AOAC Research Institute's *Performance Tested Methods* Program. This option allows for evaluation and review of multiple test kit models simultaneously, to accelerate the availability and variety of certified test kits. The AOAC Research Institute is a division of AOAC INTERNATIONAL.



Credit: Getty Images

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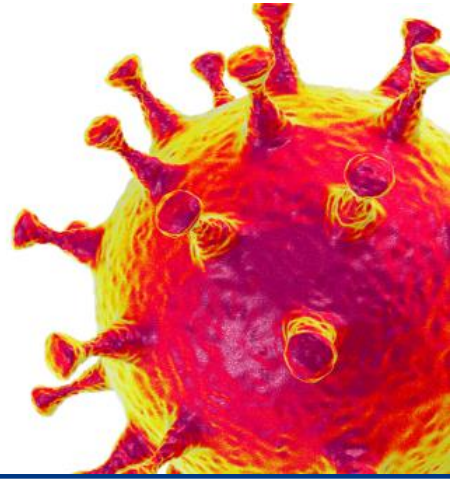

Summary

- Viruses can survive on surfaces and remain infectious for a period of time.
- Analysis of viruses faces challenges and there are not a lot of analytical tools to address the need for viral testing.
- The VIR*Seek* solution offers an all-inclusive, workflow from swabbing recommendation, RNA extraction to the specific detection of important pathogenic viruses such as SARS-CoV-2

Contact Information:

If you have any questions please do not hesitate to contact us:

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Check out our COVID-19 Response page to see full list of capabilities:
https://www.eurofins.com.au/covid-19-response/

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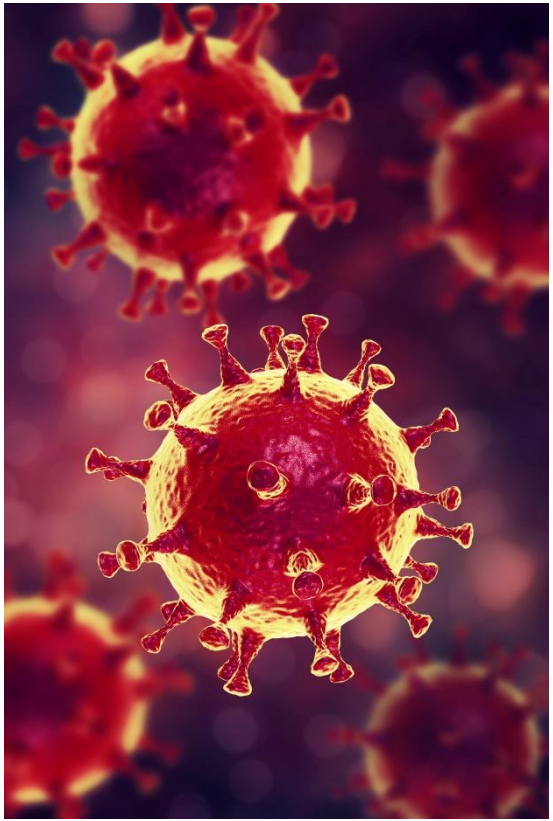

THANK YOU FOR YOUR ATTENTION!
Questions?

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What's next?

SARS-CoV-2 in Wastewater

Unknown Unknows (QToF)

Dioxins

Mobile Asbestos Testing

Microplastics