

# Introducing Dynabeads Speakers



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Expertise: EM, cell isolation, exosomes,  
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Expertise: cell isolation, exosomes,  
immunoprecipitation, automation, Dynabeads

## ***Invitrogen Dynabeads™ Intact Virus Enrichment*** (optimized for SARS-CoV-2)

Ketil W Pedersen  
Berit Marie Reed

 The world leader in serving science

The Dynabeads™ magnetic beads are sold exclusively by Veritas Corporation in Japan.

# Agenda

1 Introduction to Dynabeads magnetic beads

2 Introduction to SARS-CoV-2 and enrichment strategies

3 Enrichment of SARS-CoV-2 with Precipitation Reagent

4 Enrichment of SARS-CoV-2 with Dynabeads

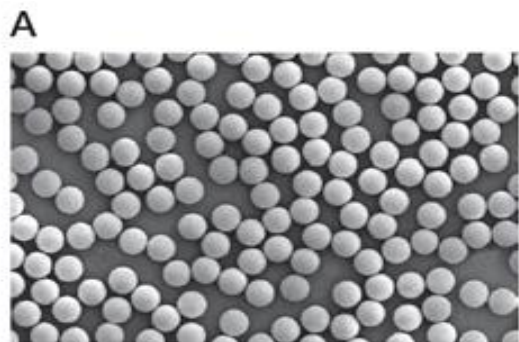
5 Wastewater testing and summary

“There is  
no shortcut  
to achievement.”

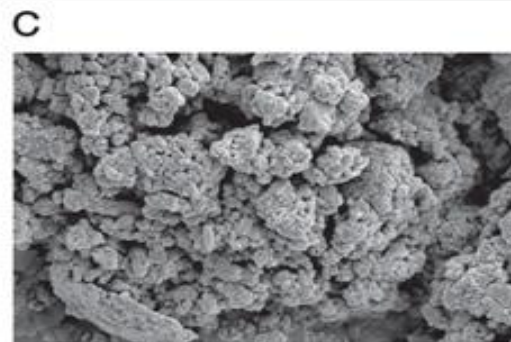
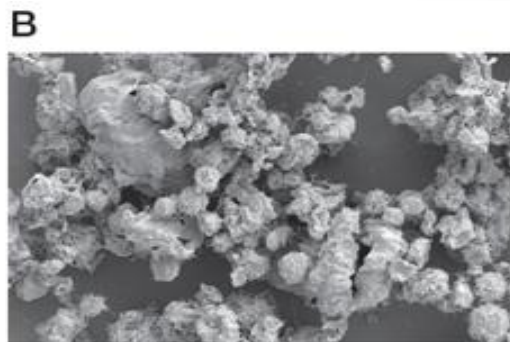
# What are Dynabeads™ Magnetic Beads?



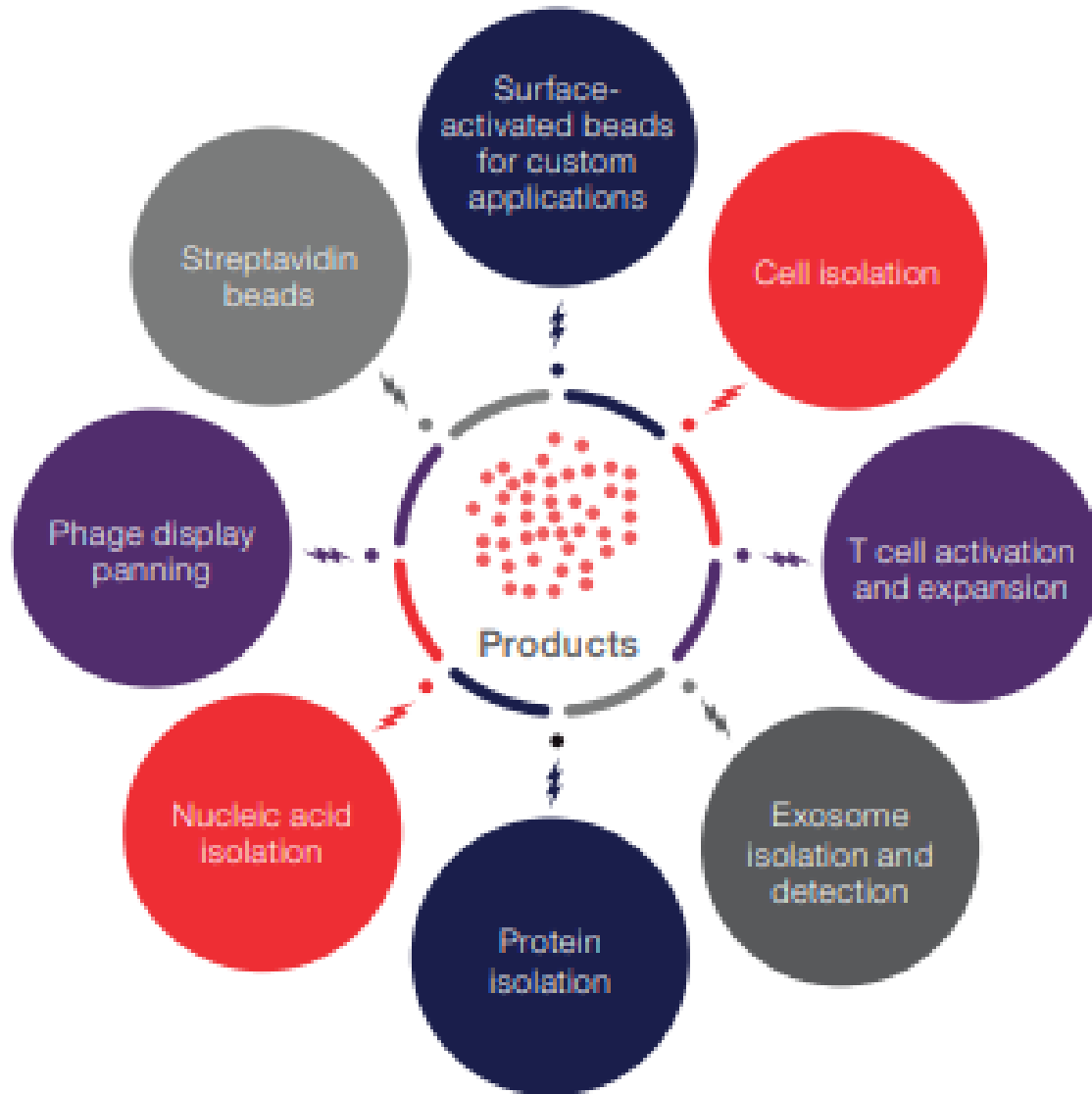
- ✓ Dynabeads products >35 years! The bead pioneers!
- ✓ Only company with truly monosized magnetic beads
- ✓ >80 000 Scientific publications
- ✓ Used in several billions IVD tests annually (OEM)
- ✓ Known for high reproducibility, low non-specific binding and ease of use



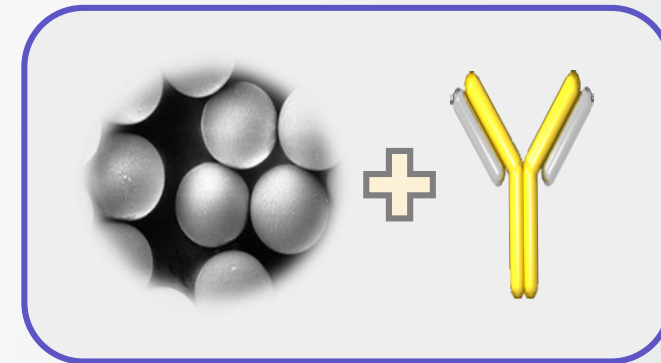
Monosized beads (CV <5%)



# One Technology – Endless Options!

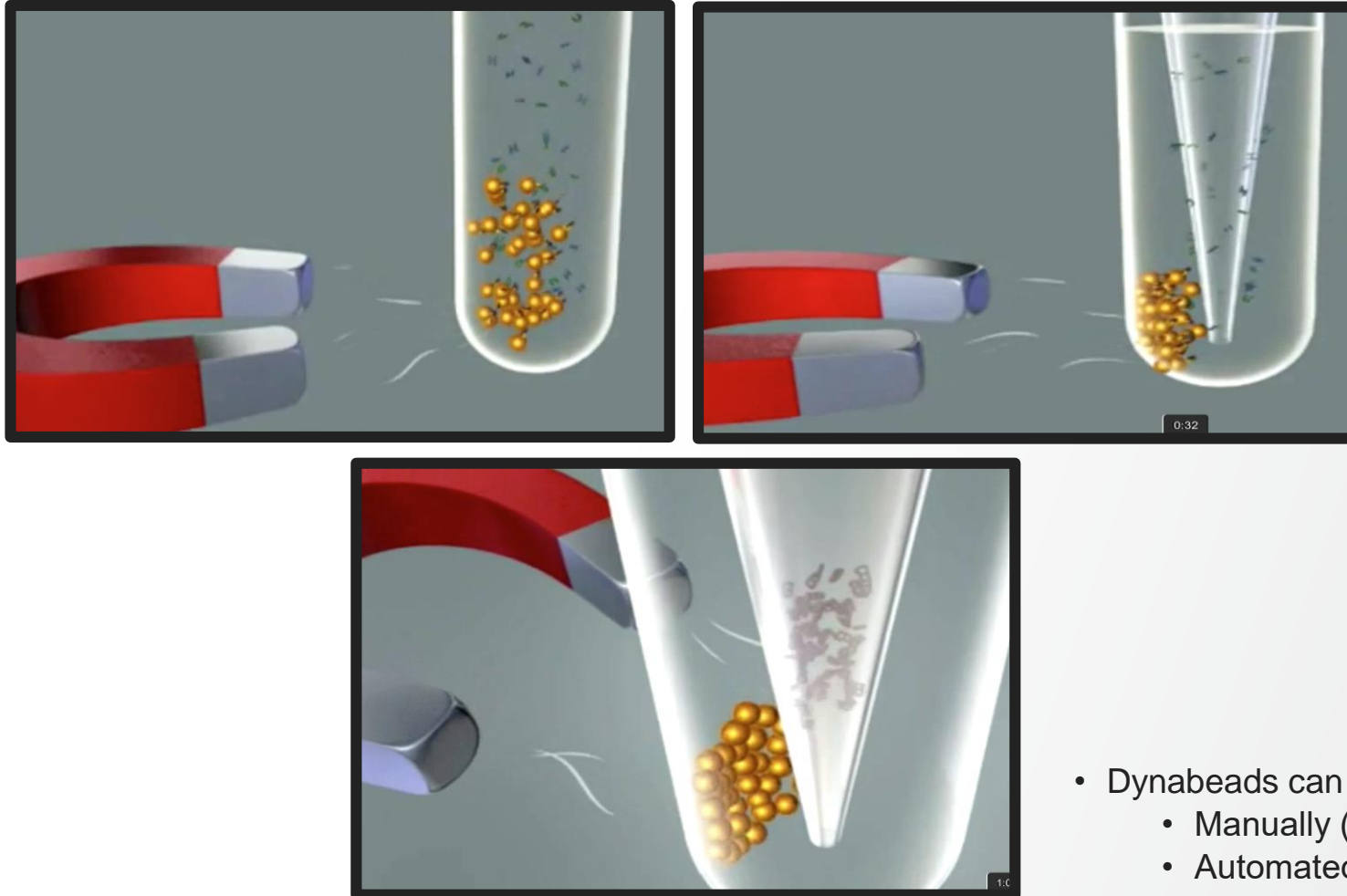


If there is an antibody towards your target, or if it's biotinylated, it can be isolated using Dynabeads products



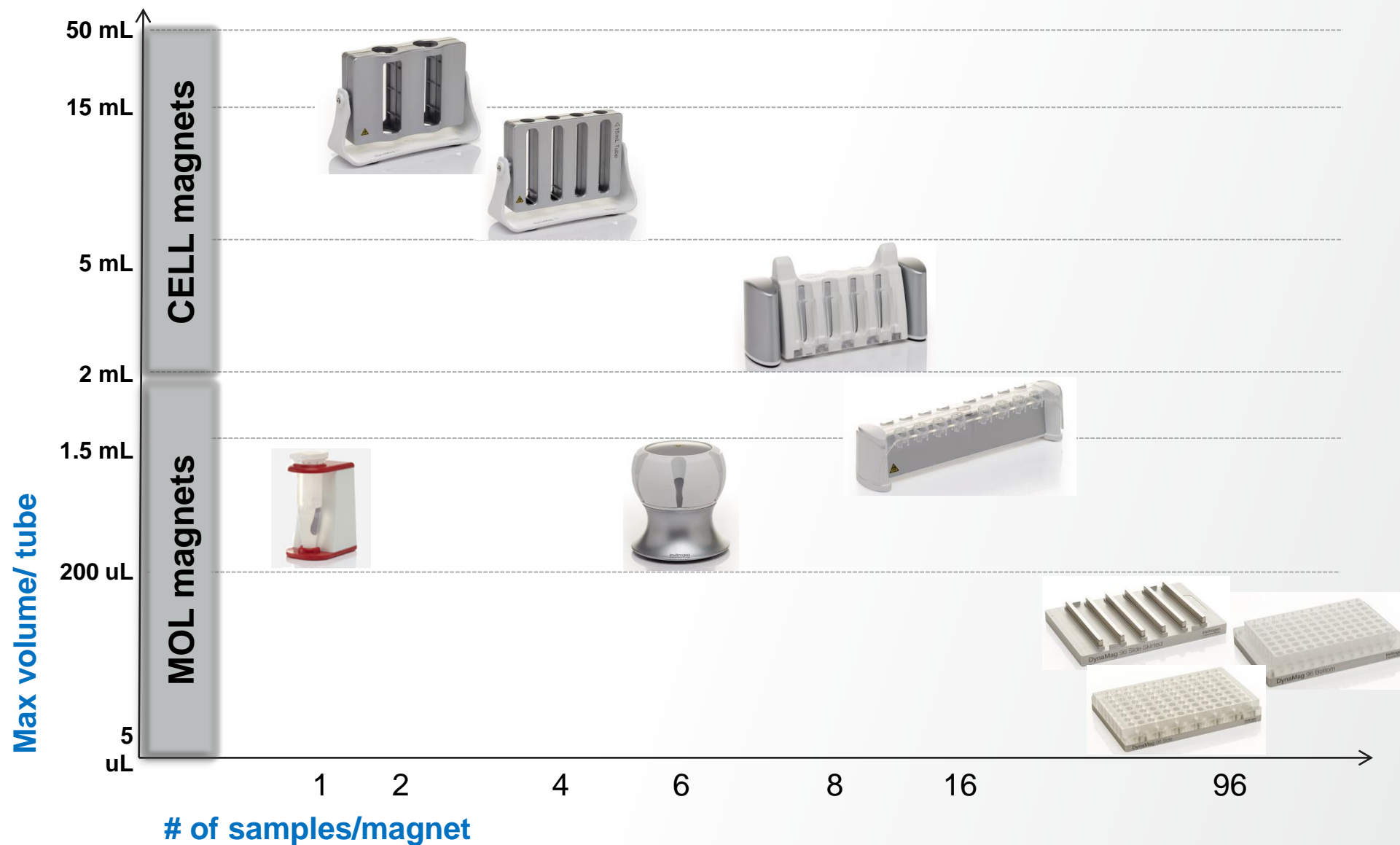
Norway manufacturing site –ISO 13485 certified

# How it Works



- Dynabeads can be handled
  - Manually (DynaMag™ magnets)
  - Automated (KingFisher™ instruments)

# DynaMag™ Magnets – Quality & Flexibility for All Needs



# Mixer & Instruments

## HulaMixer™ Sample Mixer



- Adjustable—speed range from 1–100 rpm
- Flexible—combine end-over-end rotation, tilting, and vibration (vortex)
- Versatile—two platforms are supplied to match a variety of tubes (0.5 mL—50 mL)
- Can be used in the cold room, at the bench, or in the incubator

## KingFisher™ Instruments



Duo Prime 6-12 rxn/run



Flex 24/96 rxn/run



Apex 24/96 rxn/run





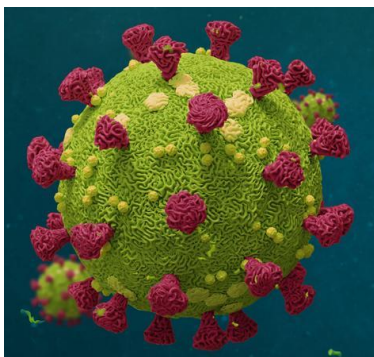
# Introduction to SARS-CoV-2



# Introduction

## Virus enrichment challenges:

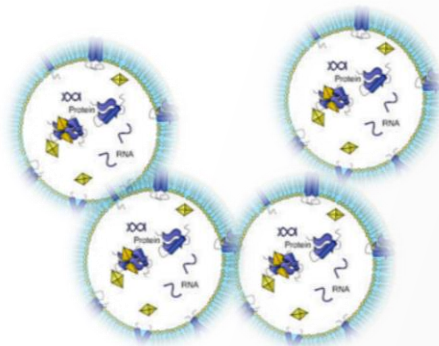
- **Virus cultures**—for sufficient virus yield
- **Genome amplification**—low virus titers introduce artificial variants or bias in the sequence reads
- **Virus surveillance**—time-consuming steps and large equipment for enrichment (e.g. ultracentrifugation)



## Purpose:

1. Purify intact SARS-CoV-2 virus from dilute samples with few steps
2. Automate purification of SARS-CoV-2 for high throughput in <30 min

### Virus isolation



### Description

- Virus concentration
- Viral characterization
- Viral host interaction

### Solution

1. Precipitation solution for manual virus purification from dilute samples
2. Invitrogen™ Dynabeads™ magnetic beads for high throughput automated virus purification

# Workflow

Manuel and automated enrichment of SARS-CoV-2 virus



**Precipitation reagent and Dynabeads beads enriches all virus types**

# Current Virus Enrichment Procedures

CMVs

Electronegative membranes

Dengue Virus

Influenza virus

Tobacco Mosaic Virus

Polyethylen glycol

Adenovirus

**Coronavirus**

Filtration

Bacteriophages

Virus Like Particles

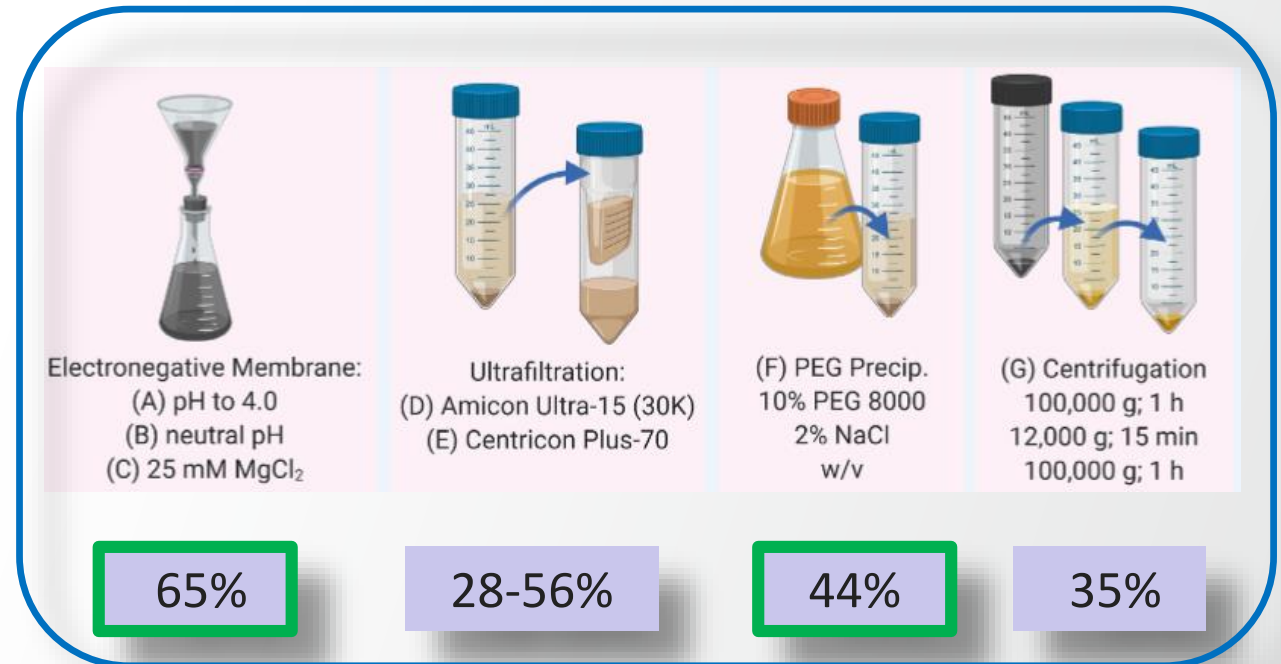
Sucrose gradients

Hepatitis virus

Enveloped virus

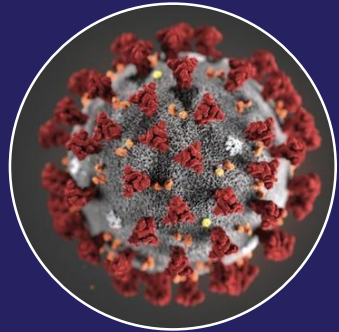
Lenti virus

Ultracentrifugation



PEG and charge-based enrichments methods gives best results according to publications

# SARS-CoV-2 Research

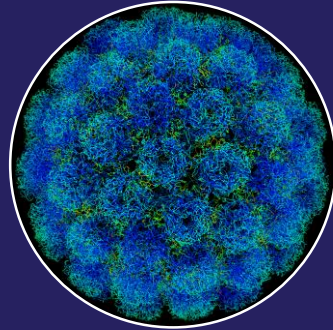


## Live virus

Isolated from patients/cultured

Contains NA

BSL-3 Labs

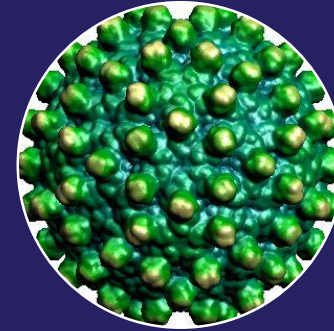


## Inactivated virus

Inactivated virus from patients/ cultured

Contains non-infectious NA

Any research lab



## VLP's

Artificially manufact. protein coatings

No NA's

Any research lab

Precipitation reagent and Dynabeads enriches all «virus» types

A close-up photograph of a woman with dark hair and eyes, looking intently at a large, stylized green virus particle. The virus particle is spherical with a textured surface and numerous red, spike-like protrusions. The background is a soft, out-of-focus blue and white.

## Precipitation Reagent

# Precipitation Reagent Benefits and Protocol

## Intact Virus Precipitation Reagent (optimized for SARS-CoV-2)

Gentle precipitation method that enriches intact SARS-CoV-2 virus from dilute sample volumes

### Benefits

- **Simple**- 3-step virus enrichment
- **Fast**- Isolate in <3 hours with short hands-on time
- **Flexible** - Dilute virus samples can be enriched from any sample volume range
- **Straight to PCR**- No further NA extraction is needed prior to PCR



- SKU #10720D
- Volume - 50 mL
- #Rxn's: 100\*

### Protocol

Add precipitation reagent to the virus sample



Incubate 2 hrs

Centrifuge 12 000 x g



15-30 min

Remove supernatant & collect the virus pellet

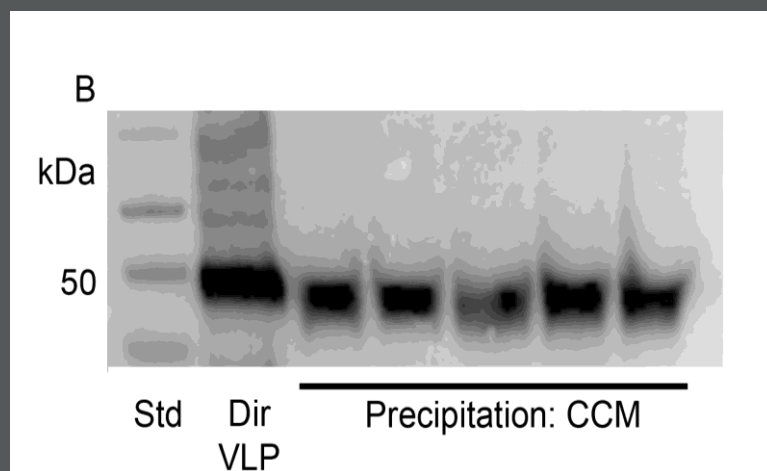
# Precipitation Reagent is Compatible with Proteomic and Genomic Workflows

## Western

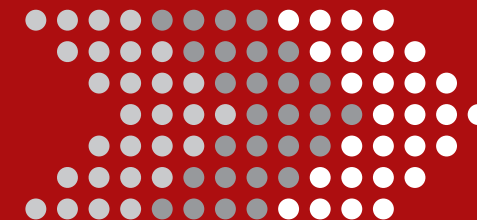


Detection of SARS-CoV-2 nucleocapsid protein N

- iBlot
- iBind
- Antibodies

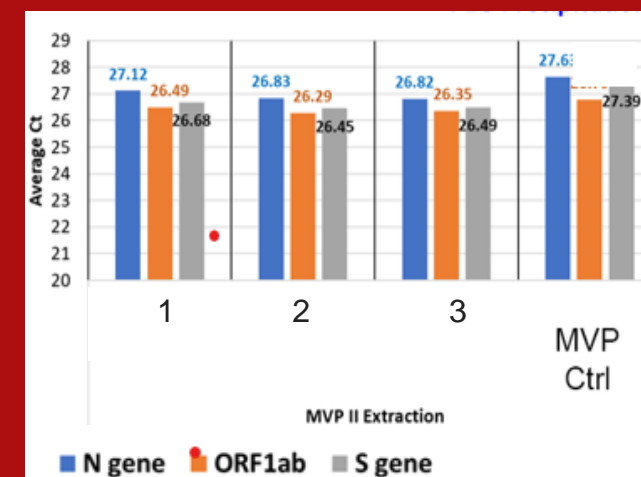


## qRT-PCR



Detection of SARS-CoV-2 genes

- Precipitation reagent
- MVP Kit
- TaqMan Covid-19



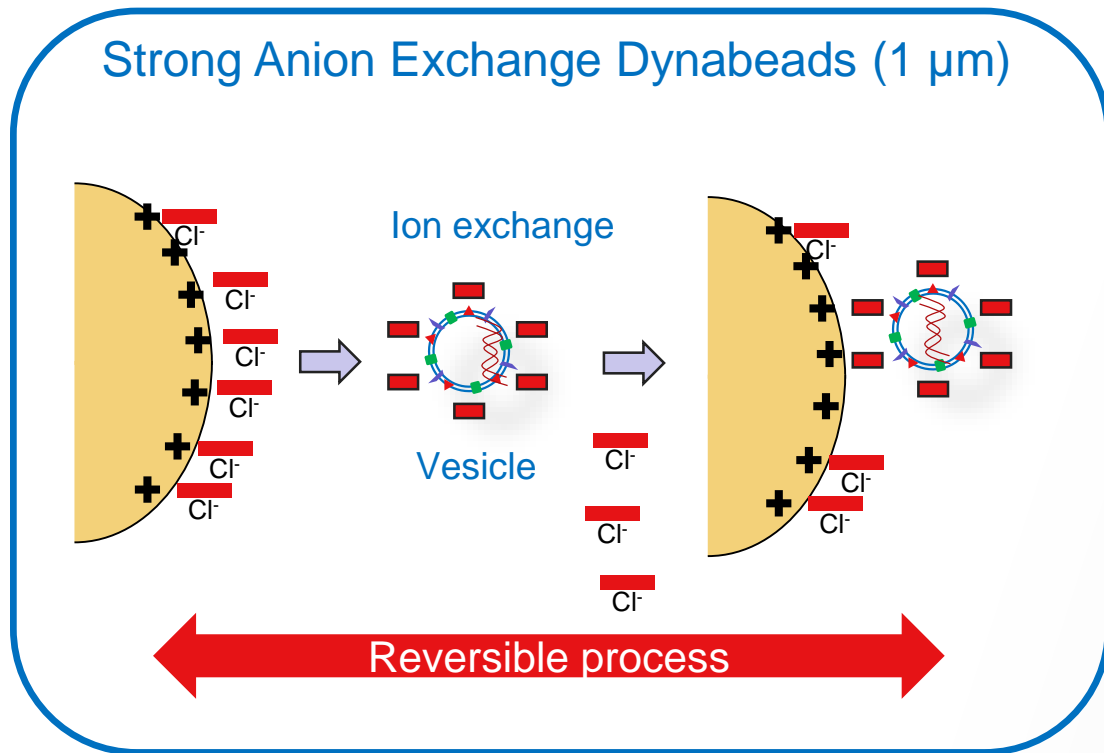


A close-up photograph of a woman with dark hair and eyes, looking intently at a large, stylized green virus particle. The virus particle is spherical with a textured surface and numerous red and yellow spikes protruding from it. The background is a soft, out-of-focus blue and white.

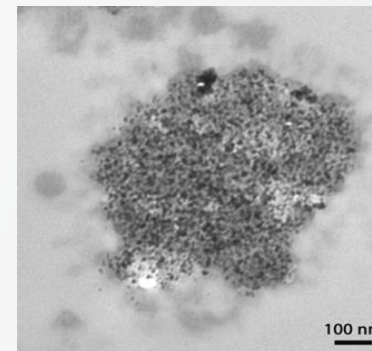
## Dynabeads™ for automation

# The Dynabeads Isolation Principle

Magnetic bead-based isolation by charge



- Fast isolation kinetics (~10 min)
- Easy to release (~10 min)
- Easy to automate (KingFisher™ instruments)
- Can be used on other negatively charged enveloped viruses, vesicles and proteins



# Dynabeads Benefits and Protocol

## Dynabeads™ Intact Virus Enrichment (optimized for SARS-CoV-2)

Gentle and fast automated isolation of intact SARS-CoV-2

### Benefits

- **Fast** – Intact virus in ~20 minutes
- **Simple** - Just push the button & walk away
- **Throughput** - Enrich up to 96 samples per run
- **Functional** – The intact virus can be used in any functional assay
- **Release**- Release virus from the beads in 10 min



- SKU #10700D/10701D
- Volume - 2 mL/10 mL
- #Rxn's: 100/500

### Protocols

#### 1 Automated protocol

Add Dynabeads, virus & buffers to the plates- push "Start"

20 min\*

\*+10 min w/release

#### 2 Manual protocol

Wash the beads & add to the virus sample

Incubate 10 min

Wash the beads w/virus

2 min

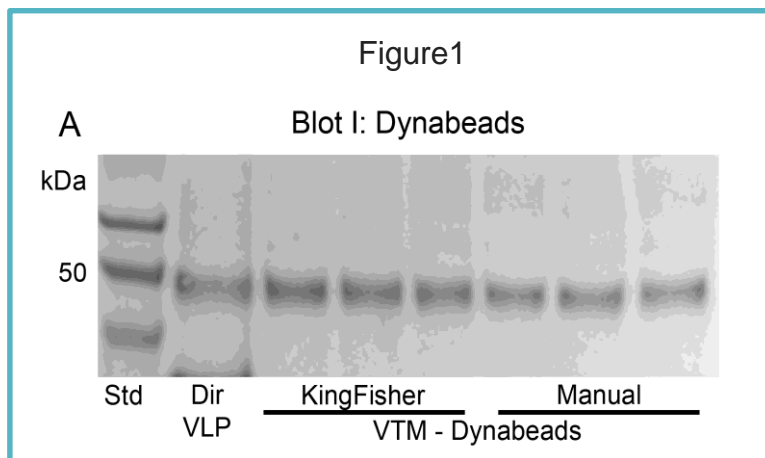
Alternatively, add buffer to release the virus from the beads

10 min

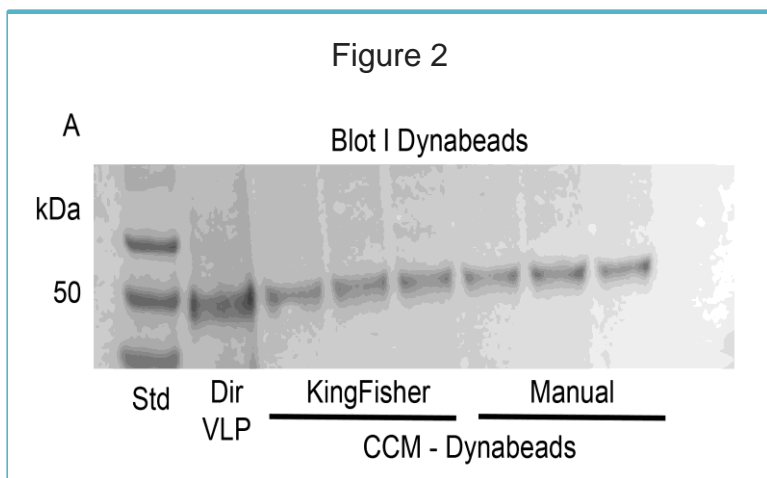
# R&D Data for Dynabeads- Western blot

Automated vs. manual isolation of VLP's from CCM and VTM media on KingFisher™ DuoPrime

From VTM



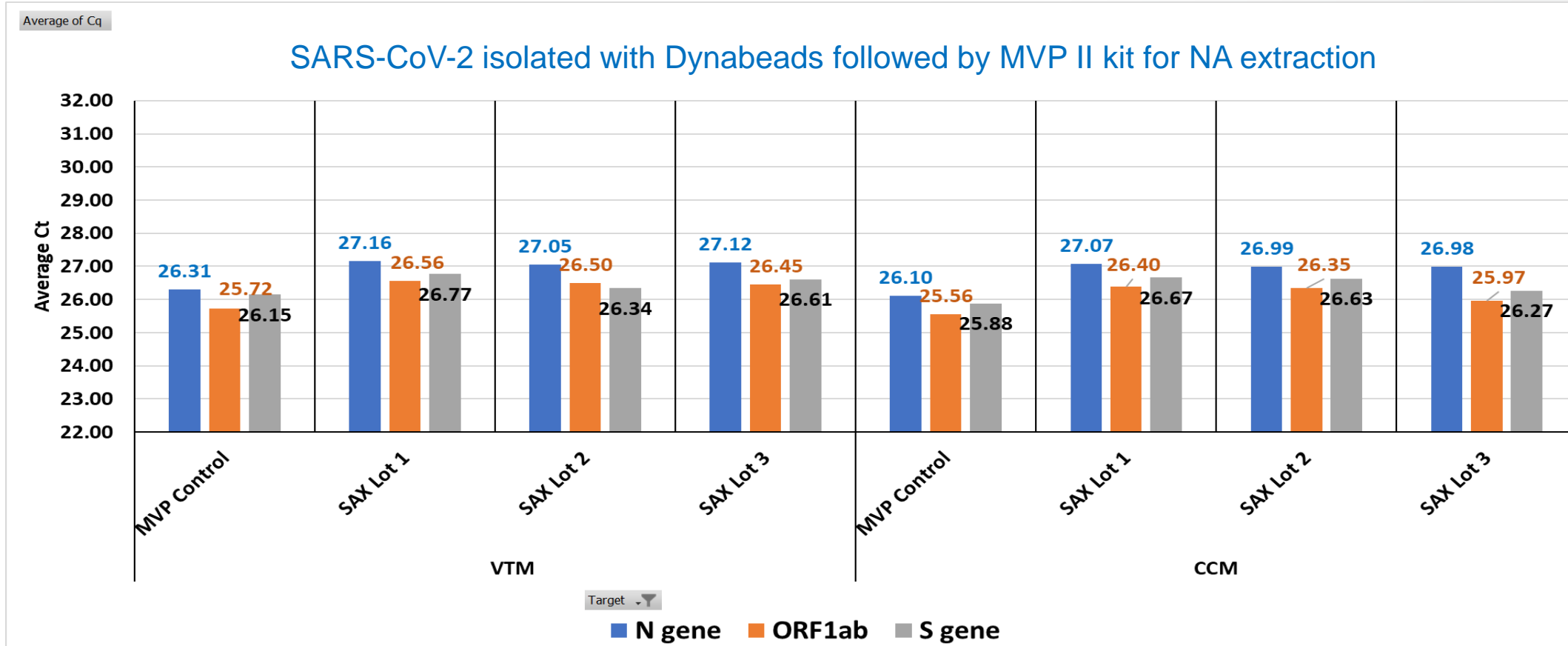
From CCM



- From VTM- 5 parallel samples
- From CCM- 5 parallel samples
- Protocol time –
  - Automated (20 min),
  - Manual (28 min)
- Detection of SARS-CoV-2 nucleocapsid protein N Compared with VLP directly from the vial (Dir VLP)

# R&D Data for Dynabeads- qRT-PCR

Enrichment of SARS-CoV-2 from VTM and CCM with high reproducibility

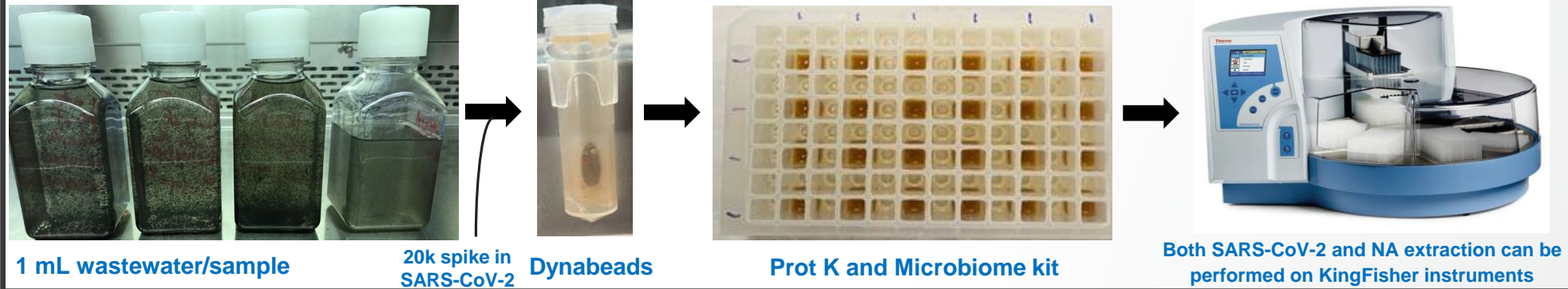


- Very reproducible results between different Dynabeads lots
- Dynabeads isolation of SARS-CoV-2 followed by MVP II extraction matches the sensitivity of MVP control

# SARS-CoV-2 Isolated from Wastewater Samples

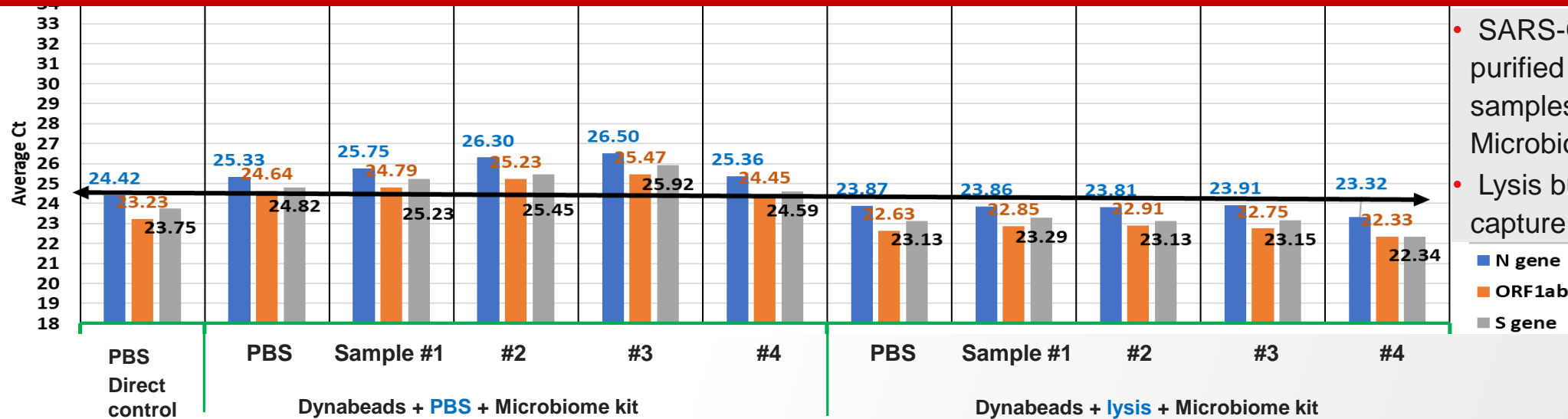
Dynabeads™ Intact Virus Enrichment (optimized for SARS-CoV-2)

## Protocol (~45 min)



1. Isolate virus w/Dynabeads
2. Resuspend in PBS or lysis solution
3. Add binding buffer
4. Add Prot K + Microbiome kit for NA purification

## Results (qRT-PCR)



- SARS-CoV-2 was successfully purified from wastewater samples with Dynabeads and Microbiome kit
- Lysis buffer shows better capture than PBS

# Precipitation Reagent vs. Dynabeads For Enrichment

When to choose what product for SARS-CoV-2!

## Intact Virus Precipitation Reagent

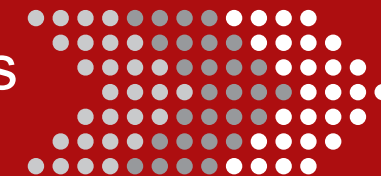


### Preferred.....

- ...for enrichment from large & dilute samples
- ...for simplicity (3 steps & short hands-on time)
- ...when no automation is needed



## Dynabeads™ Intact Virus Enrichment



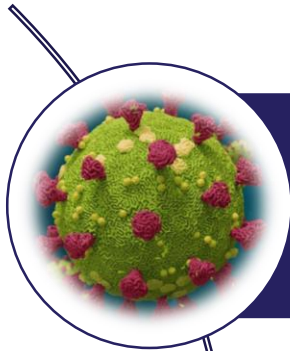
### Preferred.....

- ...for high throughput automation
- ...when time is critical (<20 min w/release)
- ...for wastewater samples
- ...for downstream mass spec



**For Research Use only. Not for use in diagnostic procedures.**

# Summary



Precipitation reagent enriches intact SARS-CoV-2 from dilute samples



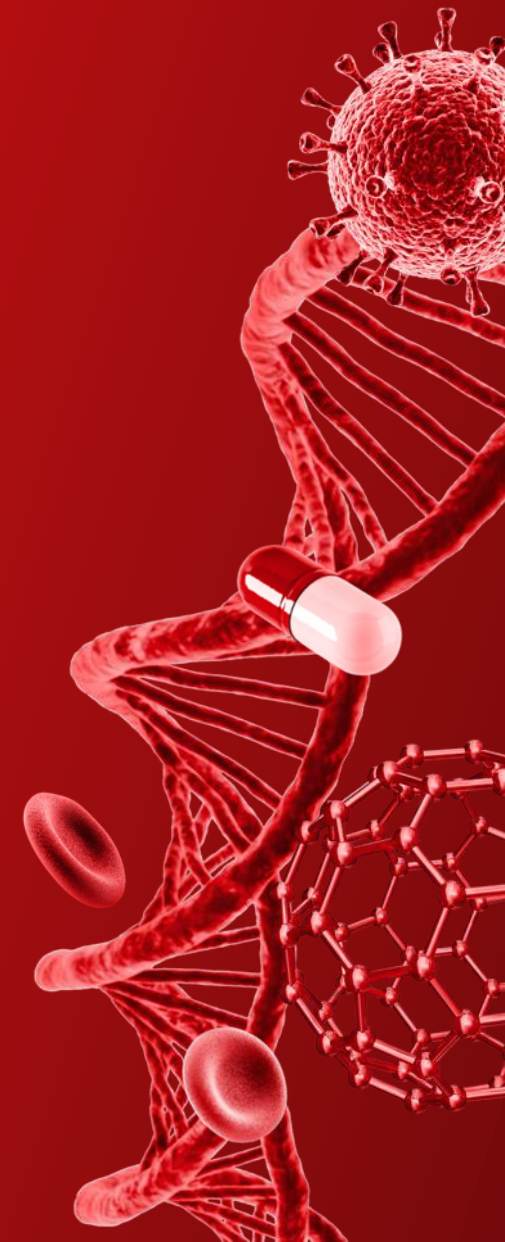
Dynabeads enriches intact SARS-CoV-2 in <30 min with virus release



Dynabeads enriches intact SARS-CoV-2 with HTTP on KingFisher instruments

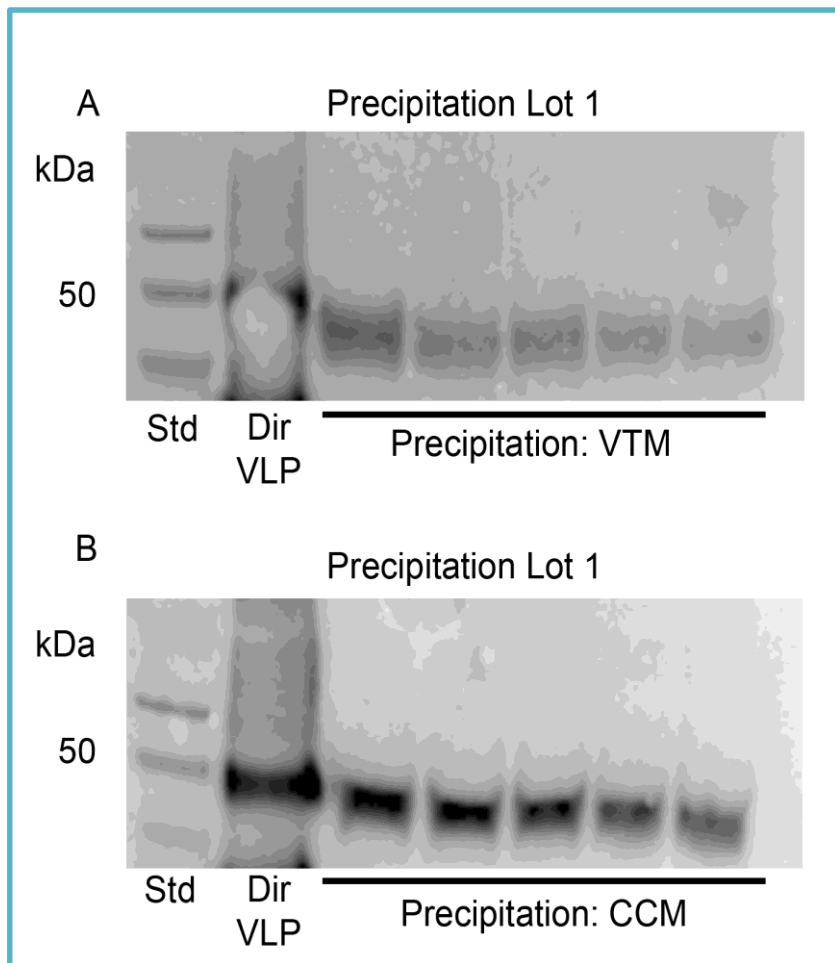


# Thank you



# R&D Data for Precipitation Reagent- Western blot

Isolation of Virus Like Particles (VLP's) from Cell Culture Media (CCM) and Virus Transport Media (VTM)



- Detection of SARS-CoV-2 nucleocapsid protein N (50 kDa)
- Compared with VLP directly from the vial (Dir VLP).
- 2 hours 40 min isolation time
- Very reproducible between different lots and parallels

