PETRI PLATES IMAGE ACQUISITION :

A COLOR CALIBRATION METHOD
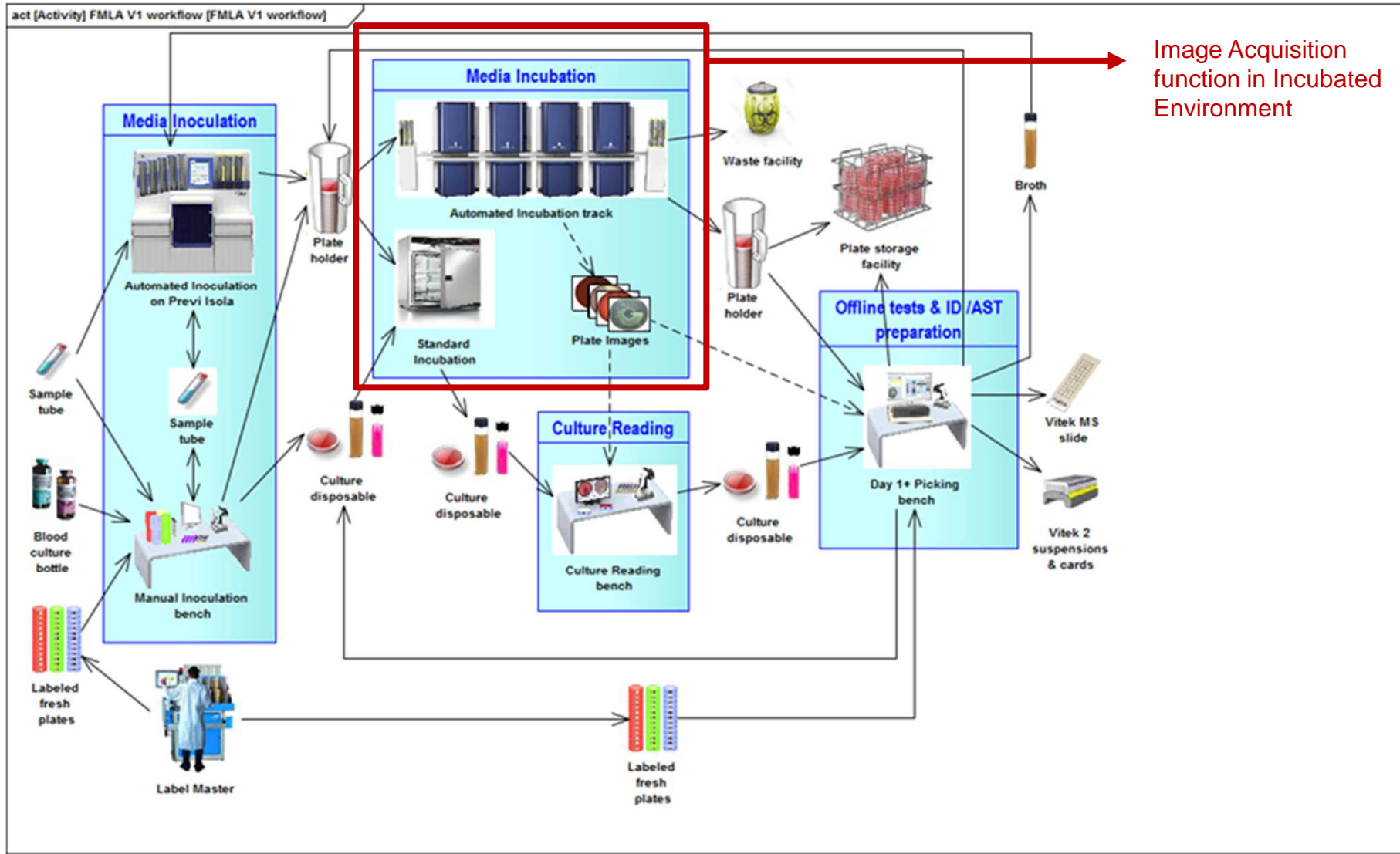
PIONEERING DIAGNOSTICS

Jeremie Pescatore, System Architect, bioMérieux
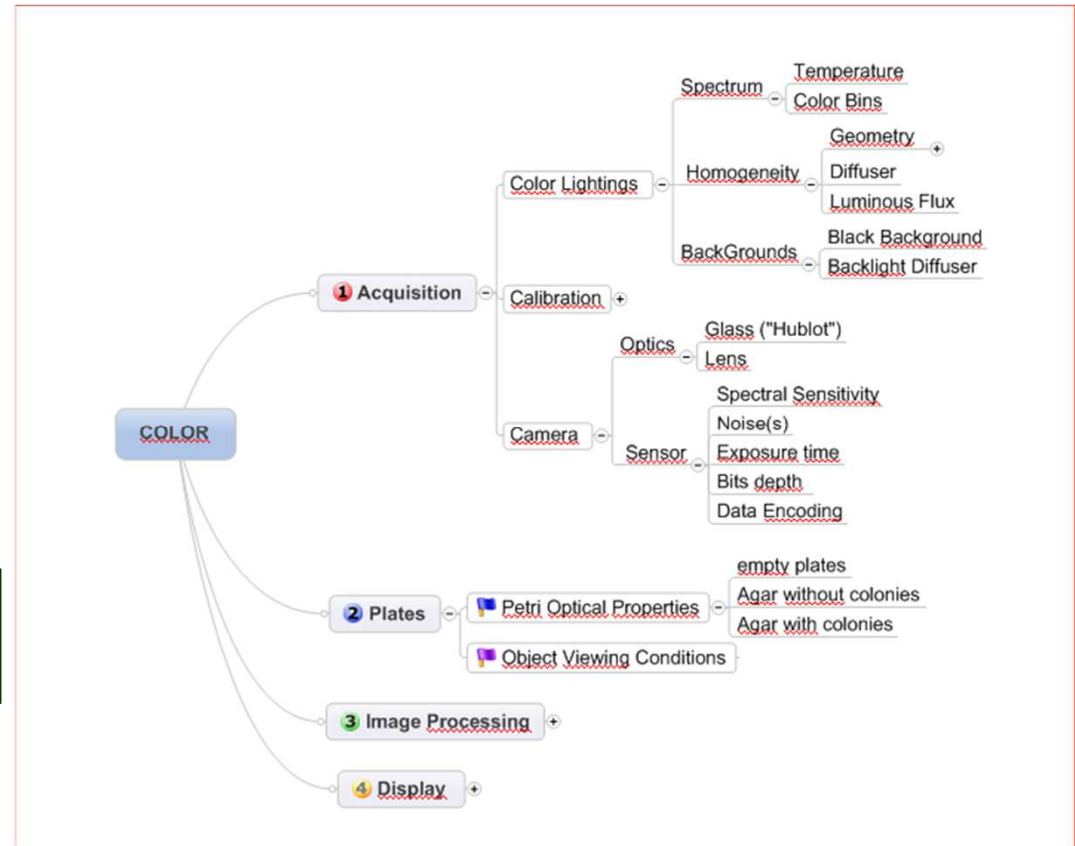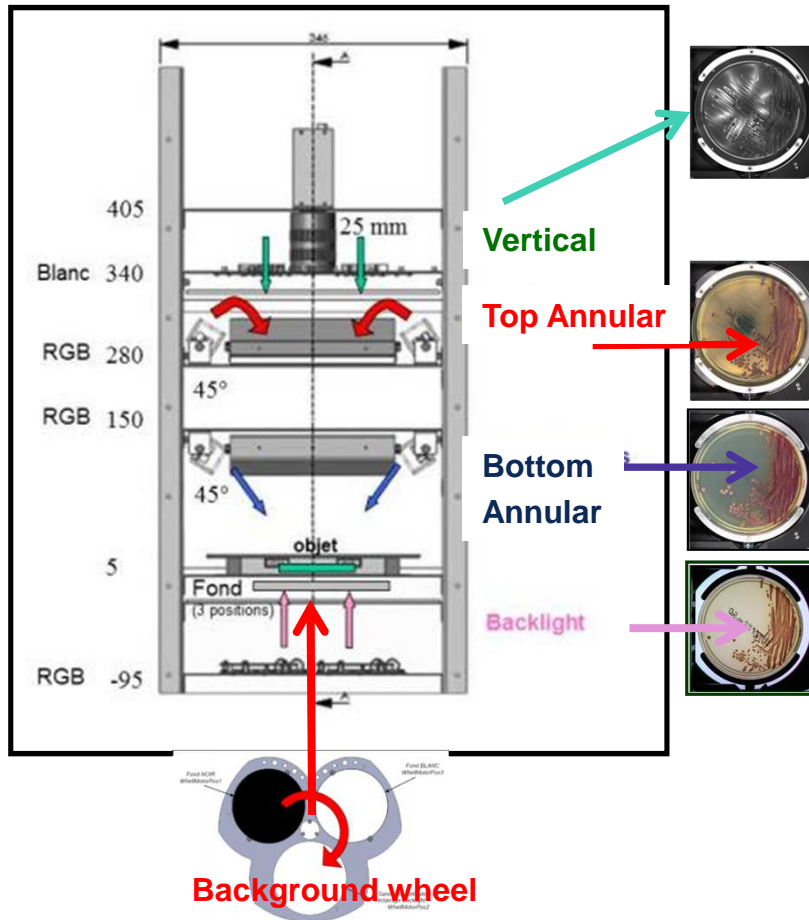
Revision 0

BIOMÉRIEUX

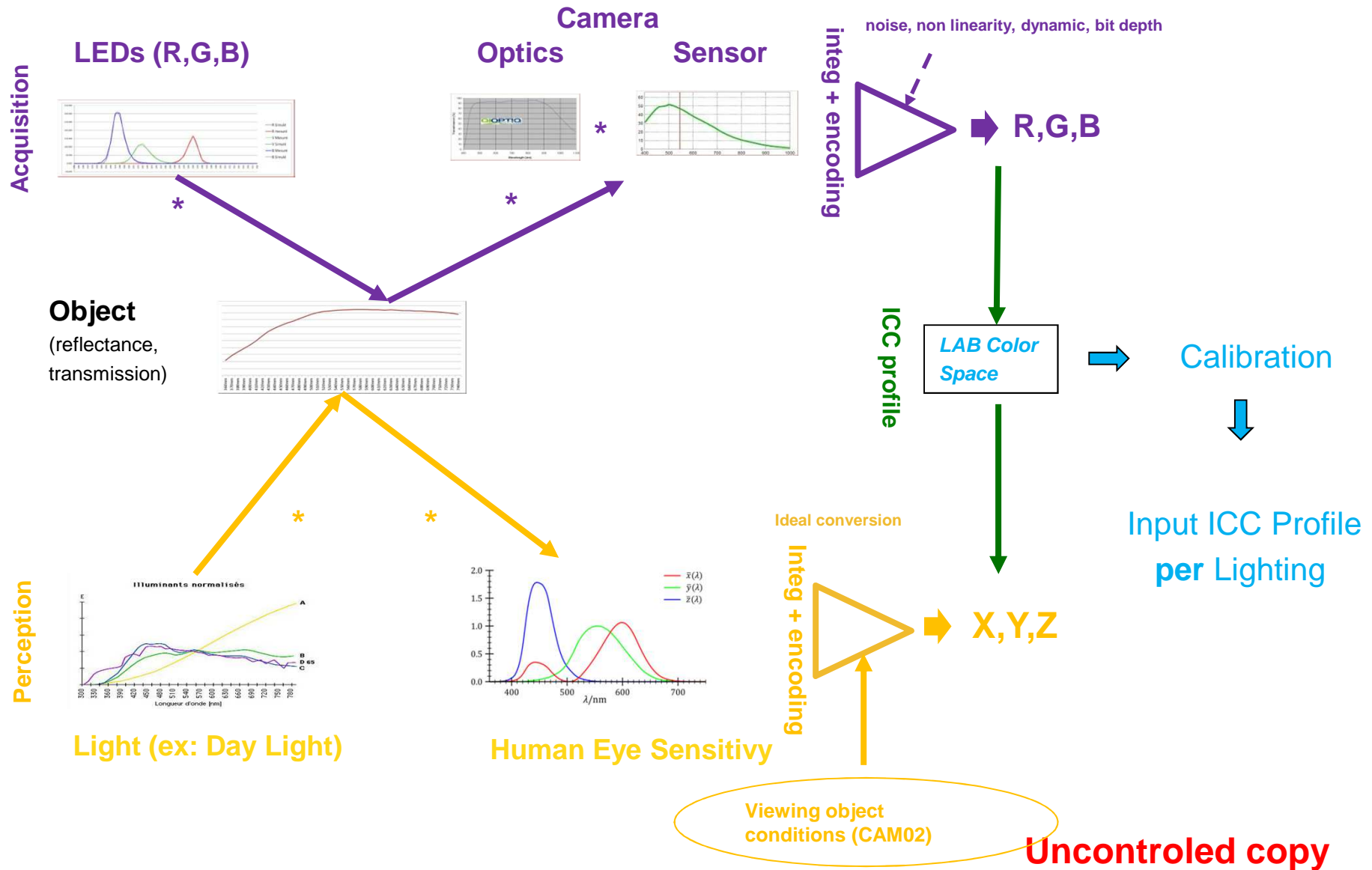# Lab Automation Workflow : Where is Petri dish image acquisition ?
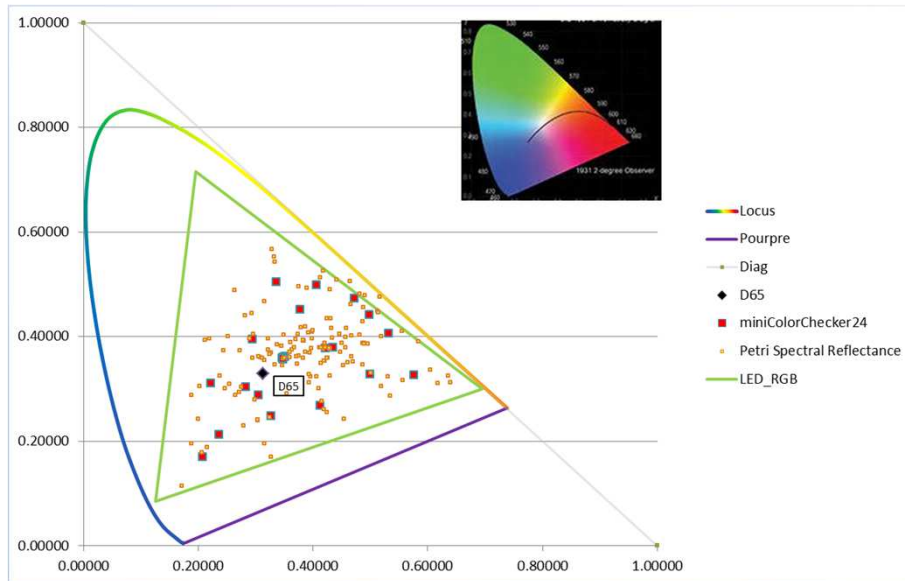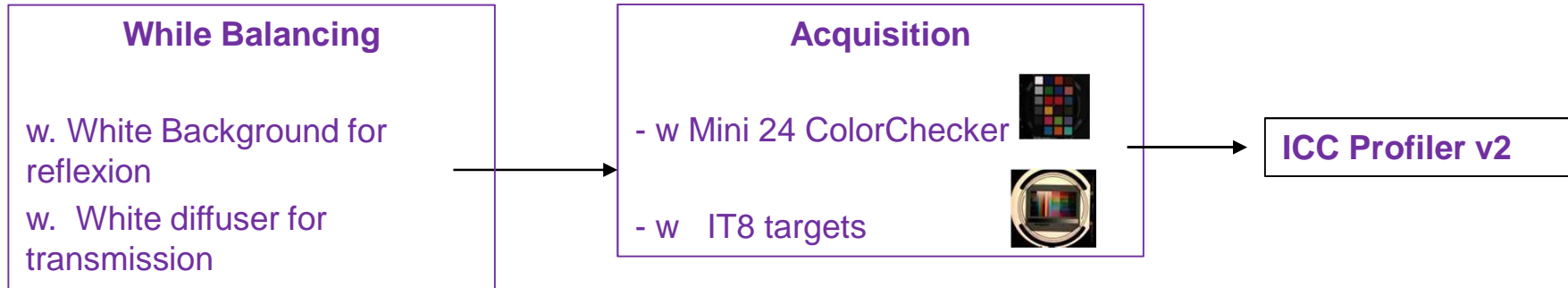
Imager : Physical description

Imager Resolution = 1800 x 1800
Pixel resolution = 47-52 µm w.r.t. focal length calibration
Field of view = 85,71 - 94,73 mm
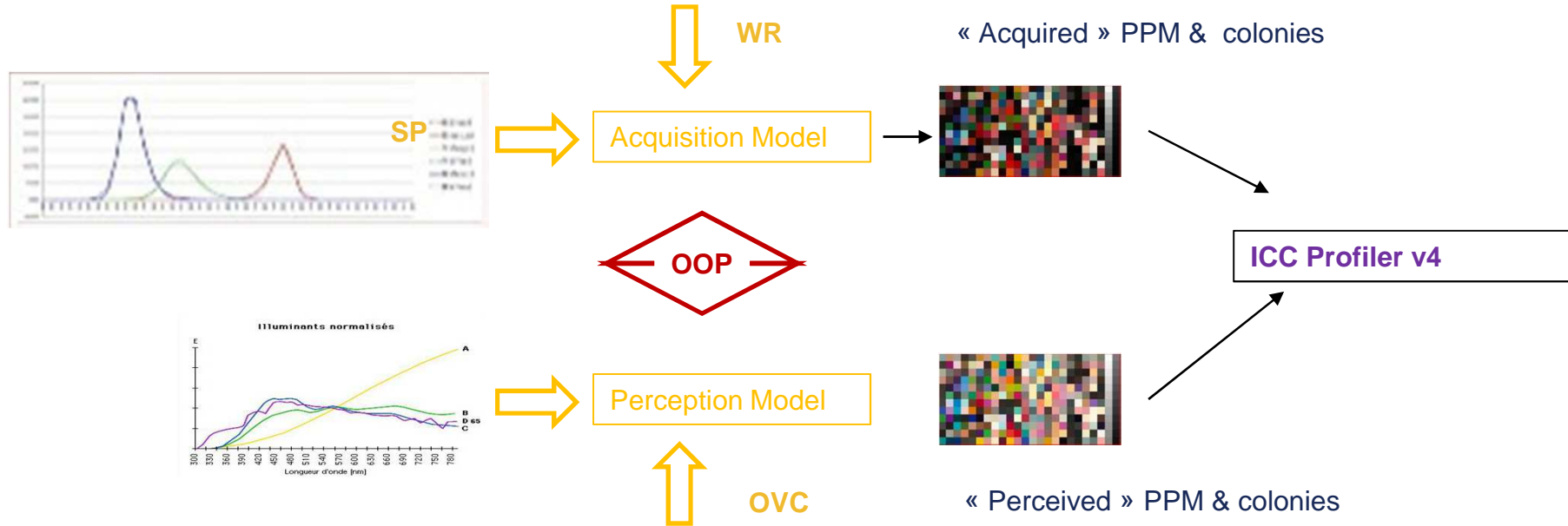
Perceived Colorimetric Model : Input ICC Profile

Acquisition

LEDs (R,G,B)

Camera

Optics **Sensor**

integ + encoding

noise, non linearity, dynamic, bit depth

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*

*

R,G,B

ICC profile

LAB Color Space

Calibration

Input ICC Profile **per** Lighting

Object
(reflectance, transmission)

Perception

*

*

Ideal conversion

Integ + encoding

X,Y,Z

Light (ex: Day Light)

Human Eye Sensitivy

Viewing object conditions (CAM02)

Petri Imager : current color calibration & goal

While Balancing

w. White Background for reflexion

w. White diffuser for transmission

Acquisition

- w Mini 24 ColorChecker

- w IT8 targets

ICC Profiler v2

Goal : minimize the perceived variability (metamerism errors)

Proposal : ICC **Model** Base Color Calibration

WR

« Acquired » PPM & colonies

SP → Acquisition Model

OOP

ICC Profiler v4

Perception Model

OVC

« Perceived » PPM & colonies

Legend :
SP : Spectral Light Properties
OVC : object viewing conditions (CAM02 model)
OOP = Object Optical Properties (Spectral Reflectance, Spectral Transmittance)
WR : white reference

How to **standardise** measure for defining spectral reflectance & transmittance ?

PPM Plates Imaging : Spectral reflectance measurement

Spectrophotomer

Measurement Setup

Spectro photomer

Petri Dish

Konica Minolta 2600d

Measurement apertures ($\varnothing$): 8 or 3 mm

Size of integrating sphere ($\varnothing$) : 52 mm

Wavelength range : 360 nm to 740 nm

Wavelength pitch : 10 nm

Light : 3 pulsed xenon lamps
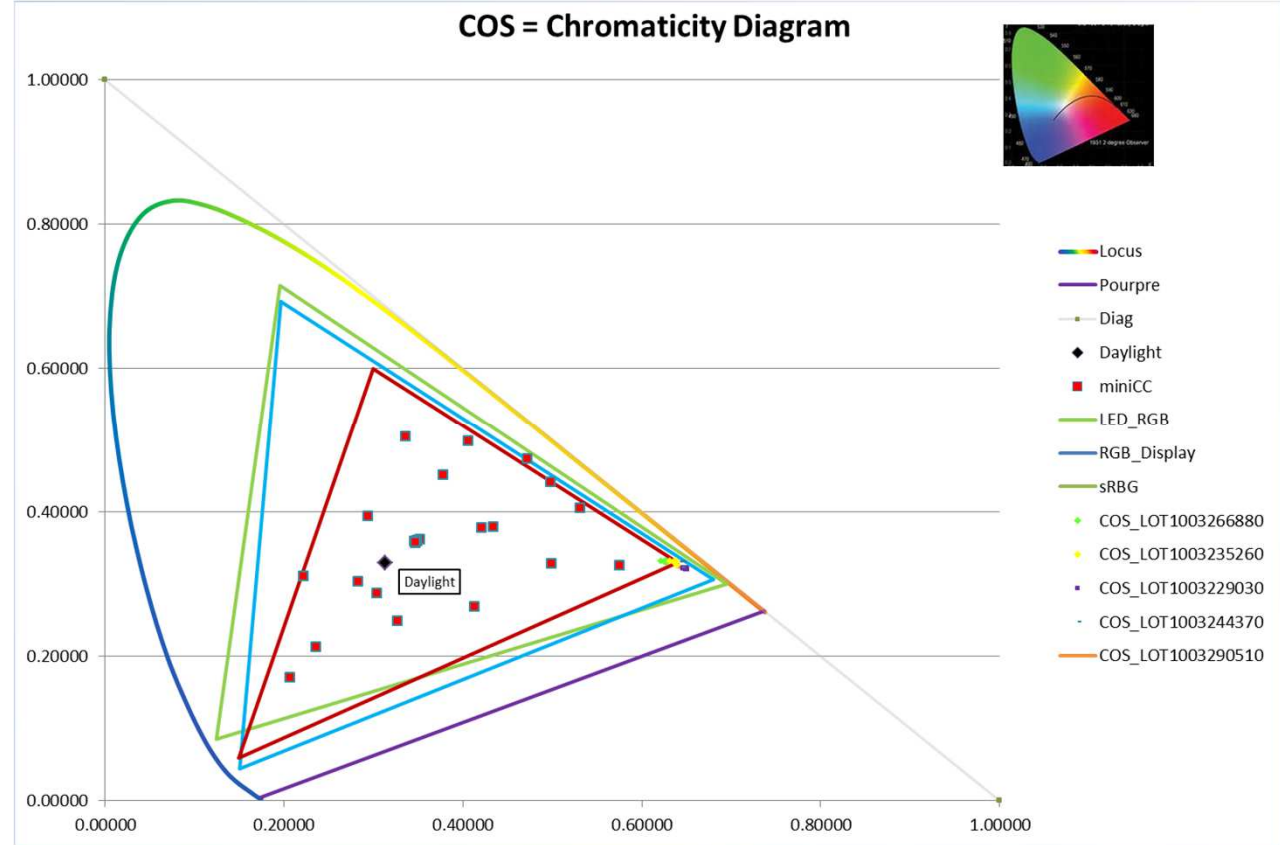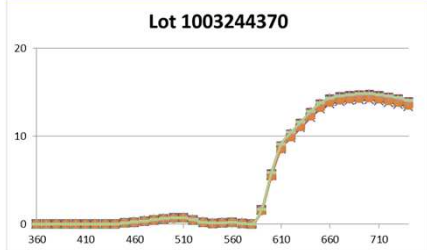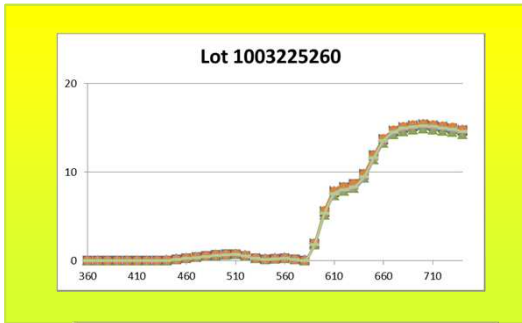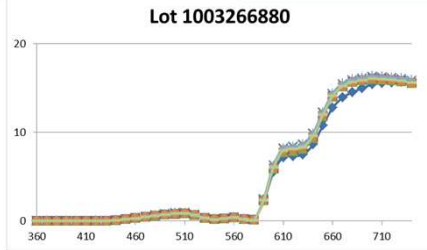
Specular included (SCI) & excluded (SCE) measures
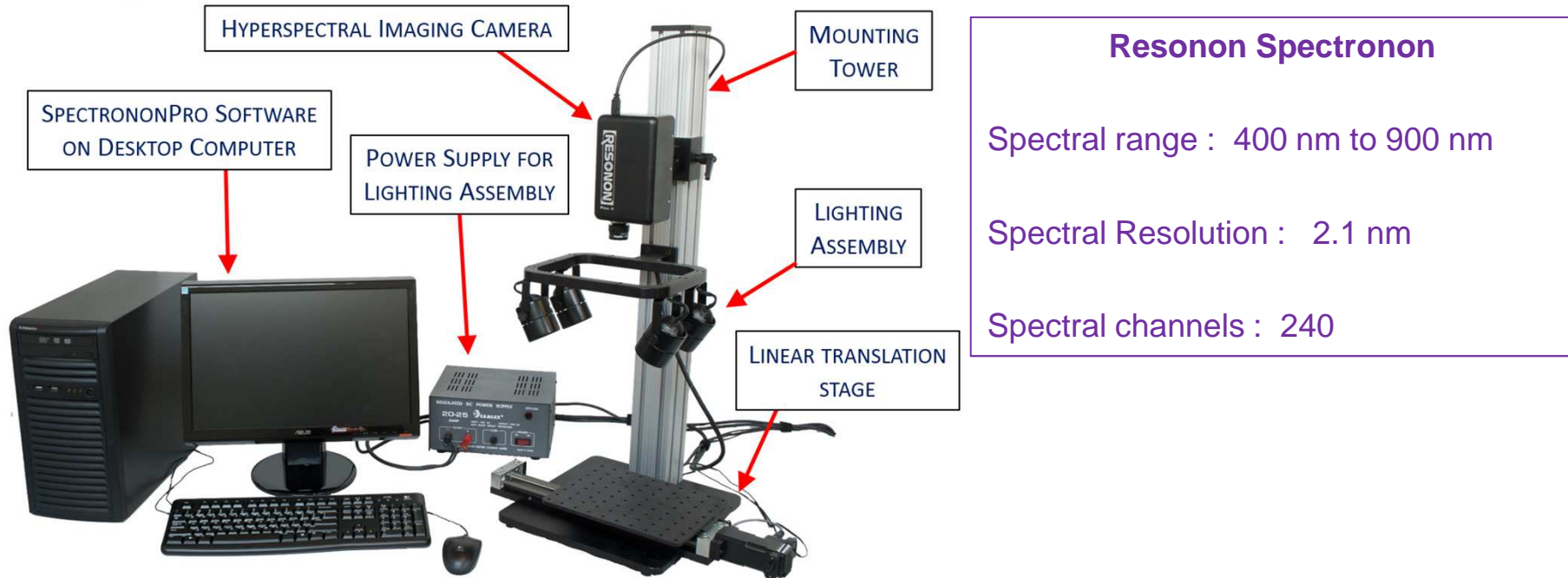
Background (White or Black)

An example : COS Spectral reflectance to XYZ (D50)

Current Limitations

➔ The minimal size is too small (3 mm) : difficult to measure isolated colonies (1 to 2 mm) optical properties

➔ No spectral transmittance measure possible with this device

➔ Variability of the distance of the device to the petri plates may have an impact (ie : specular component)

HSI : InVivo Spectral Measurement System

Resonon Spectronon

Spectral range : 400 nm to 900 nm

Spectral Resolution : 2.1 nm

Spectral channels : 240

Can make sense in a biological characterisation context:

- ❑ **Fast** analysis (<5 seconds) ➔ large spectral signatures database

- ❑ **High** resolution measurements (< 1 mm) ➔ single colony signature

- ❑ Reflectance & Transmittance **simultaneous** measures ➔ no time effect

- ❑ **Contact less** system ➔ no cleaning & contamination issue

ICC model based calibration

- Can we build a **normalised s**etup to measure spectral signature of petri images (w and wo) specular component) ?

- Can we build a **equivalence** measurement system a the golden standard being the spectrophotomer (at least for reflectance) ?
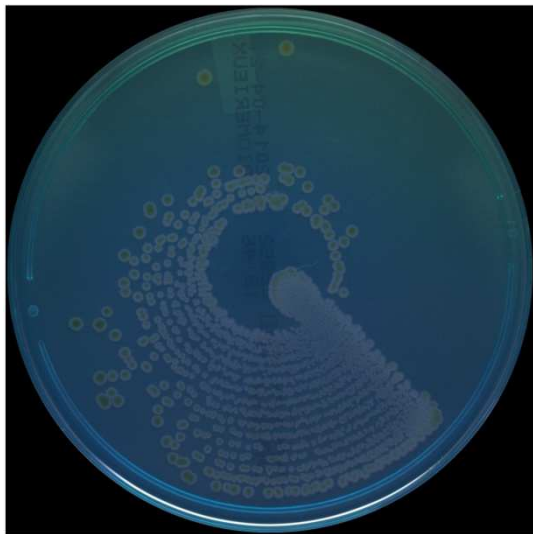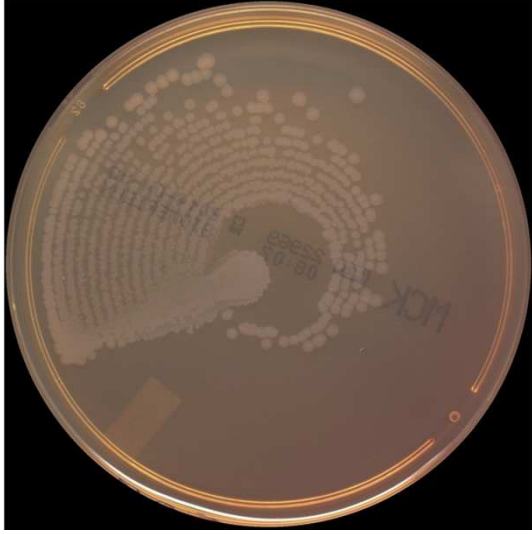
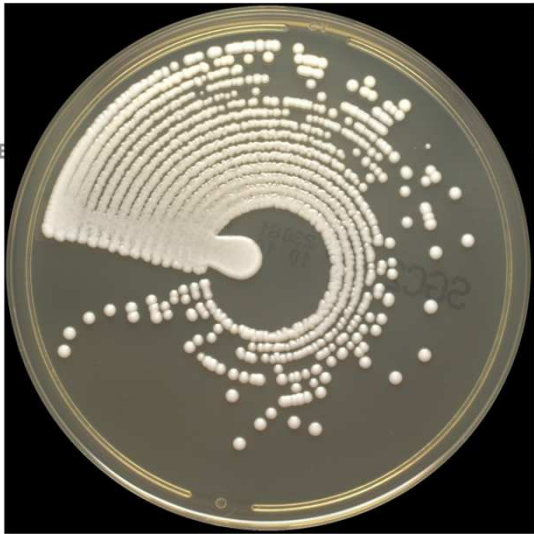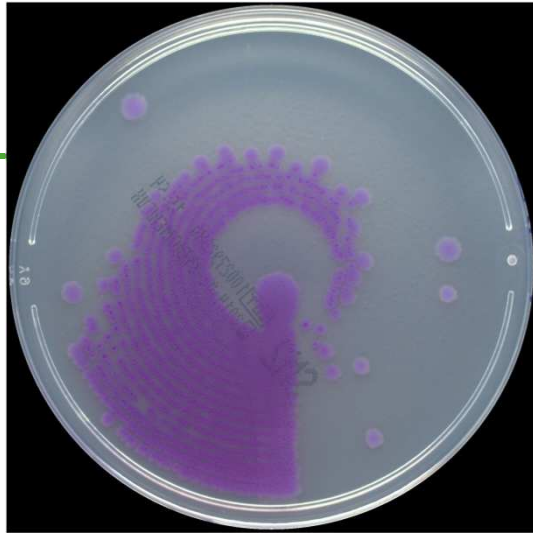# A few images of Petri Plates ....

CAN2 / UCA
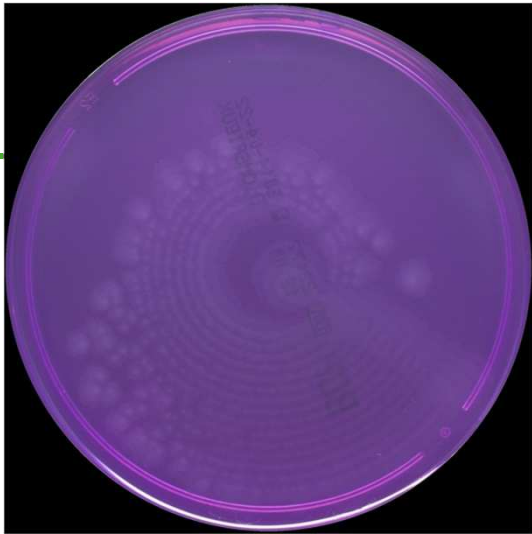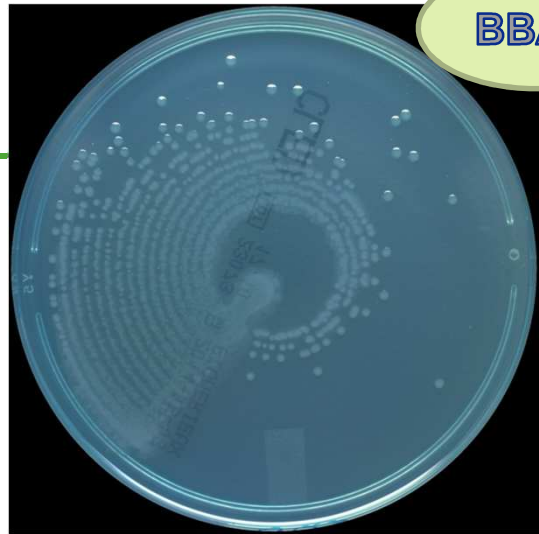
BCP / EQB

CLED / EQB

DRIG / EQB

MCK / EQB

PAID / PPA

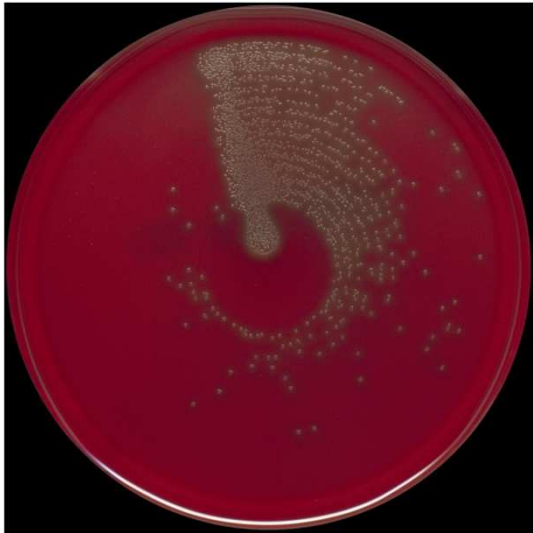**SGC2 / UCA**
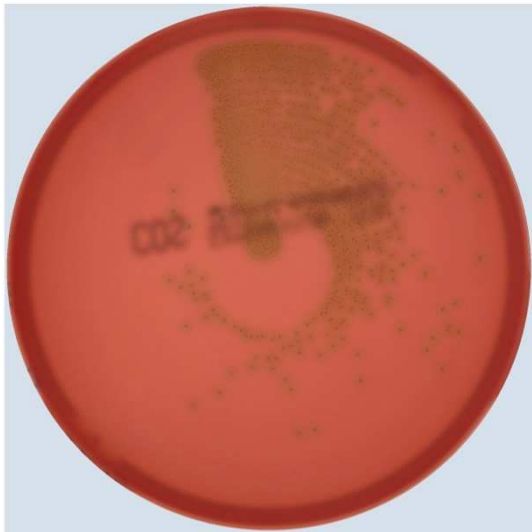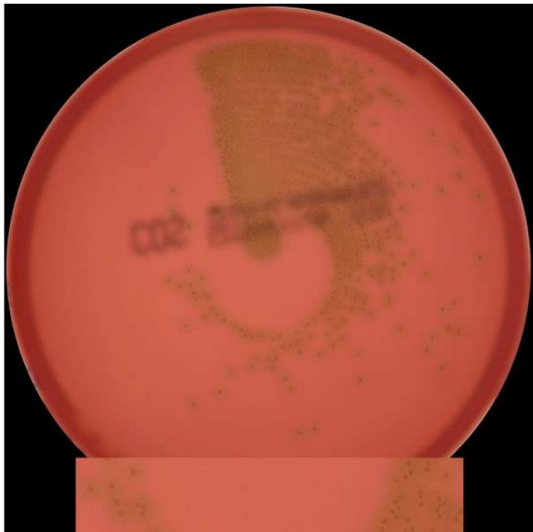
SM2 / EOM

STRPB / SAG

URI4 / KPN
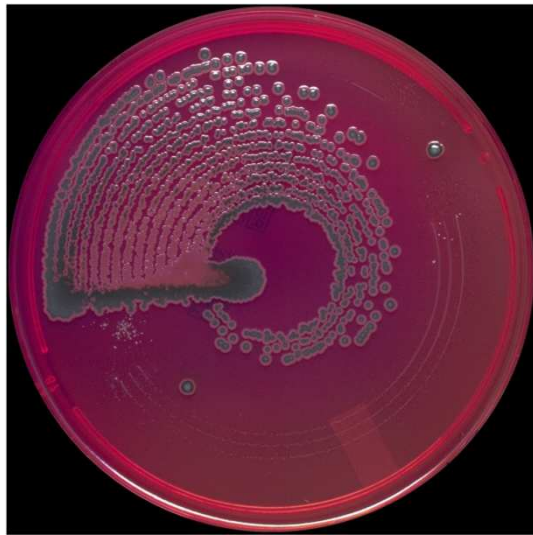
XLD / EOM

XLD / ESF

COS / SPN 0510039

BBAB

BL
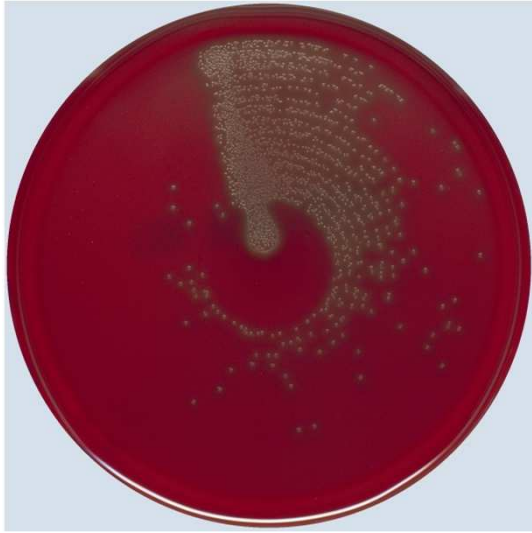
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THANK YOU FOR YOUR ATTENTION

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