

Automation of the inoculation step: what system to choose?

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Conflict of interests ?

In Lausanne, we use the WASP (COPAN), the SIRWEB (I2A), MOLIS (V4H), Tecan robots, Hamilton robots (Roche), GenXprt systems (Cepheid), Becton-Dickinson blood cultures system, Vitek (BioMérieux), Bruker MALDI-TOF, ... but we have no conflict of interest with any of these companies ...

Copan supported partially my hotel/travel costs

Relationship with industry

- Research agreement with SUEZ-ONDEO (France)**

Table

1. Introduction

- Why ?
- Automation and IT
- Available instruments

2. How to choose an automated inoculation system ?

- Instruments characteristics
- Characteristics of the laboratory

3. Conclusions

1. Why automation is needed ?

Why ?

- Reduced financial and human resources
- Increased activity (4% per year)

⇒ solution is automation

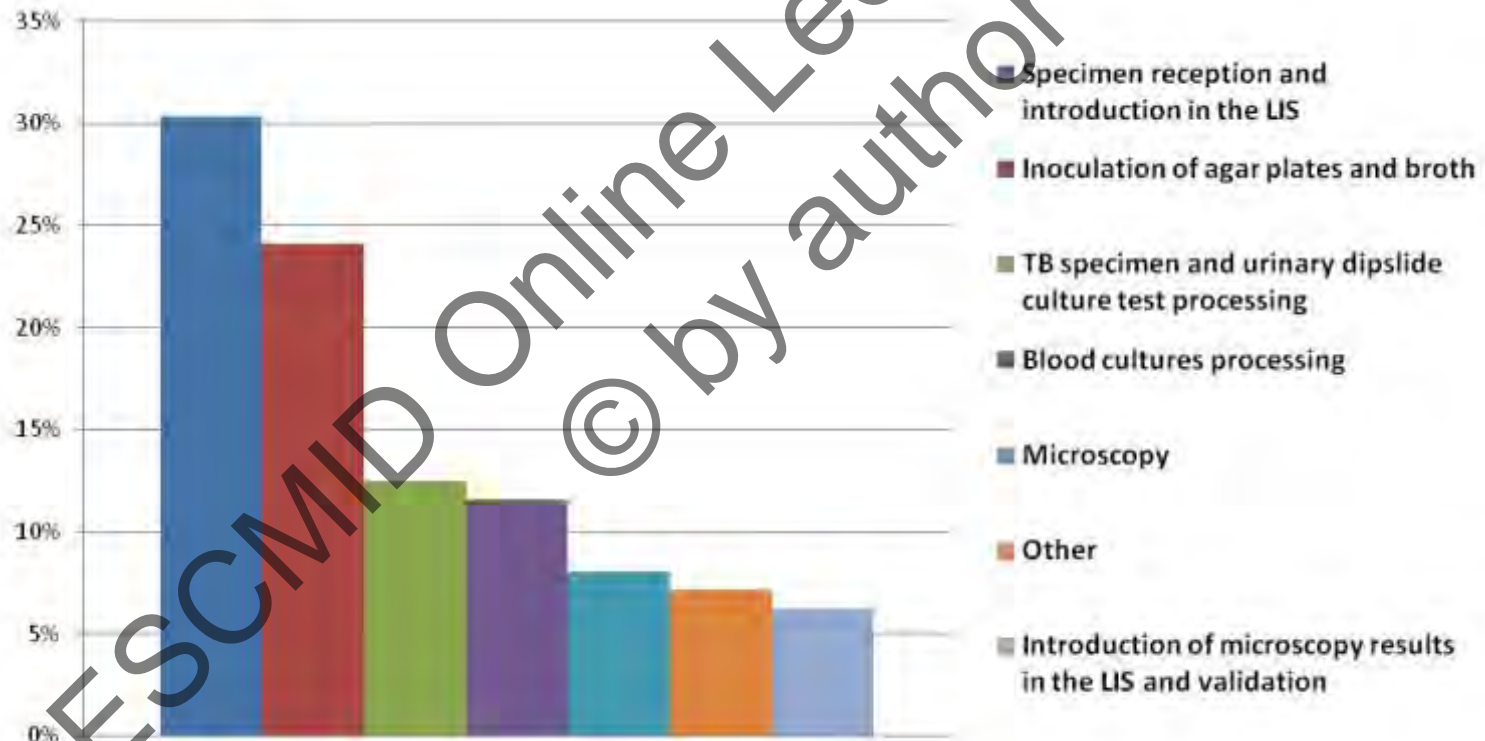
Additional benefits:

- increased quality
- increased time for other activities

1. Why automation is needed ?

Inoculation step

- sample inoculation is a fastidious & repetitive process
- represents 24% of preanalytical tasks in our lab



1. What is automation ?

Automation

Automation



new method

- added value of the new process (patent)
- need validation and adaptation

≠

Mecanisation



robot replacing humans

- easier to implement

1. What is IT ?

IT = information technology

- **need of IT coupled to automation (to avoid semi-automation)**
- **IT needed to control automation**
 - **control = making something perform a task**
 - **automation without control: always same task is repeated**

1. Automation

It is time for automation

1. Improved laboratory information systems (LIS)
2. Increased use of bar code to trace samples/ broth/ agar plates
3. Inoculab (Dynacan) already available since > 20 years

but

- low capacity (38 plates)
- uni/bidirectional with LIS

= 1st/2nd generations

1. Automation

WASP (Copan)
PREVI Isola (BioMérieux)
Innova (Becton-Dickinson)
Inoqua (Kiestra)

= third generation



Bourbeau et al



Picture from BioMérieux



Picture from Kiestra

1. Automation

WASP (Copan)

PREVI Isola (BioMérieux)

Innova (Becton-Dickinson)

Inoqua (Kiestra)

= third generation

Allow high throughput accurate inoculation, including the following 4 steps :

- 1. selecting the appropriate Petri dish**
- 2. inoculating the sample efficiently**
- 3. spreading the inoculum**
- 4. labeling and sorting each inoculated plate**

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2. What inoculation system to choose ?

Characteristics of the instruments

- **General characteristics:**

- size, weight
- noise



- **Productivity**

- number of agar/hour
- number of broth per hour

- **Inoculation**

- pattern: custom/single streak/circular
- dispensable devices (captive or not)
- type of device :
 - bead
 - calibrated loop
 - comb



2. What inoculation system to choose ?

Characteristics of the instruments

- **Samples**
 - Loading capacity
 - Various containers compatible
 - Liquid and/or semi-liquid samples
 - Automated capping/uncapping
- **Biosecurity issues**
 - HEPA filter
- **Non-inoculated media**
 - Loading capacity, number of silos
 - Different agar plates, biplate agar, broth media, ...
- **Inoculated media**
 - Sorting possibilities (samples, atmosphere, ...)



Picture from Copan

2. What inoculation system to choose ?

Characteristics of the instruments

- **Relationship with the laboratory information system**
 - Bi-directional
 - Coding protocol
 - Need for an additional interface
- **Accuracy and quality control**
 - Reproducibility
 - Comparison with another system
 - Risk of sample contamination
 - Traceability (stickers, ...)
- **Maintenance**
 - Cost and frequency of maintenance
 - Technical support from the company (delay,...)

2. What inoculation system to choose ?

Characteristics of the instruments

- Options

- Automated smear preparation
- Automated transfer to incubator
- Chain of automation including automated reading of broth and/or agar plates



Picture from Kiestra



Picture from Copan

2. What inoculation system to choose ?

Innova (Becton-Dickinson)

- **calibrated loop/re-usable**
- **any pattern** (Four quadrants, single streaking, bi-plate, ...)
- **six silos (\cong 270 agar plates)**
- **200 containers (on 5 drawers)**
- **Agitation (per rack)**
- **180 samples/hour**
- **Automated decapping/recapping**

2. What inoculation system to choose ?

Previ-Isola (BioMérieux)

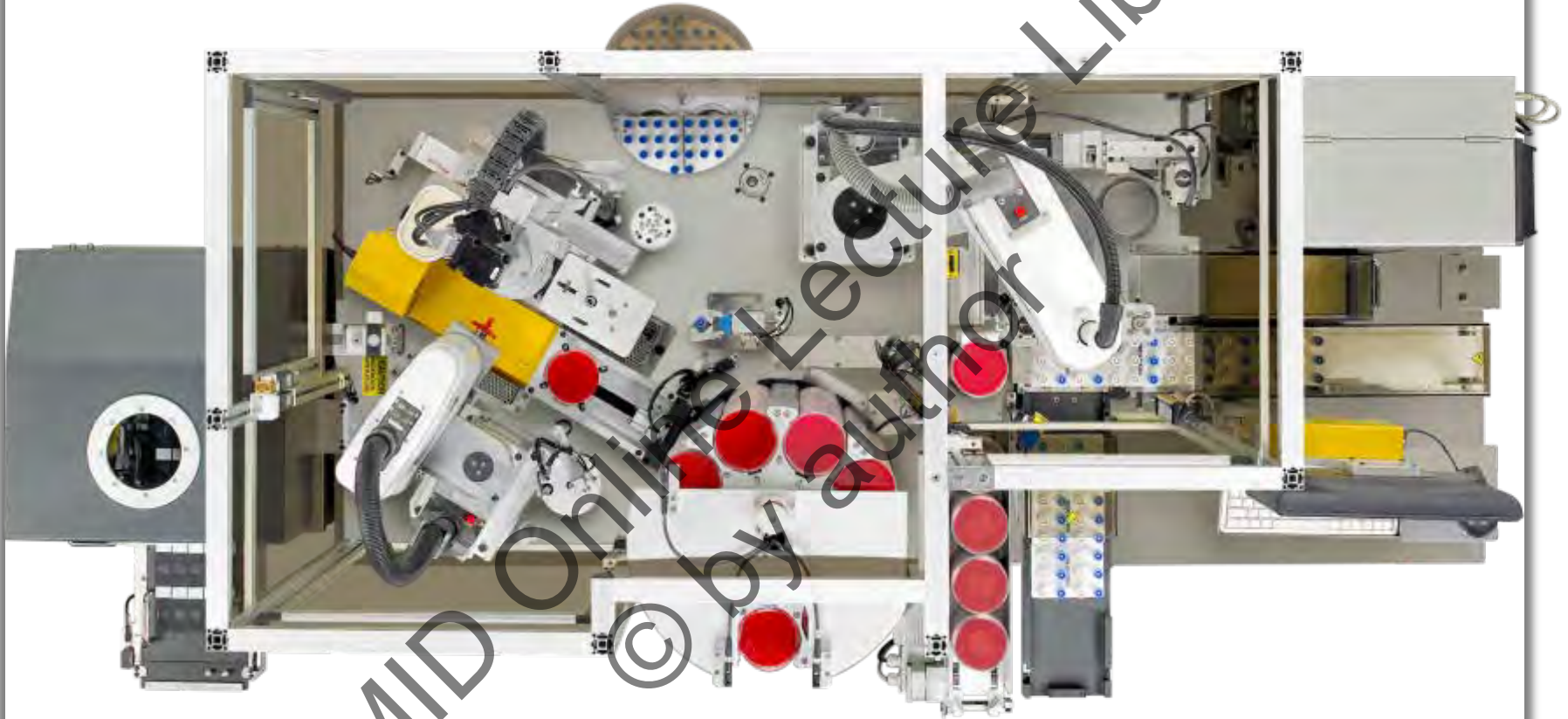
- Disposable comb
- Circular pattern
- Manual decapping
- Five input silos
- Three output silos



Picture from BioMérieux

2. What inoculation system to choose ?

The WASP



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2. What inoculation system to choose ?

The WASP

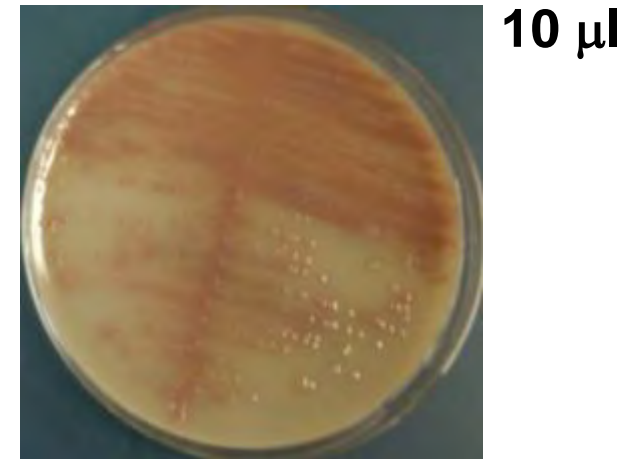
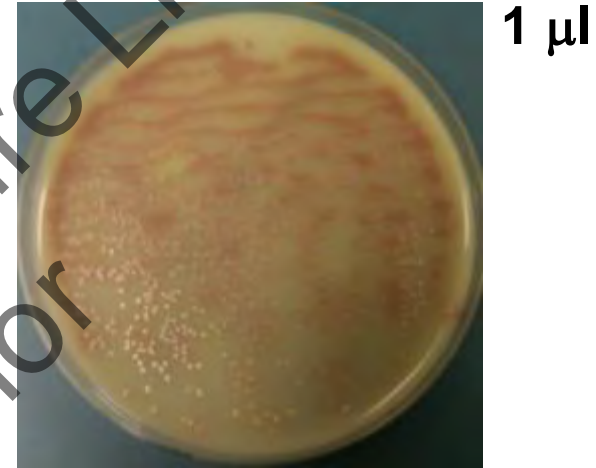


- **calibrated loop/re-usable**
- **mechanization → any pattern**
- **nine silos (\cong 350 agar plates)**
- **agitation/ centrifugation**
- **smear module**
- **biosecurity**
- **automated decapping/recapping**
- **chain of automation (soon)**

2. What inoculation system to choose ?

Inoqula-FLA (Kiestra)

- Beads
- Any pattern
- 400 cm long spreading
- 400 plates/h
- Closed dish inoculation
- Six buffers (720 plates)
- Full chain of automation



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Characteristics of the lab

- Number of samples processed
very large laboratories



goal ? - only urines
- all samples

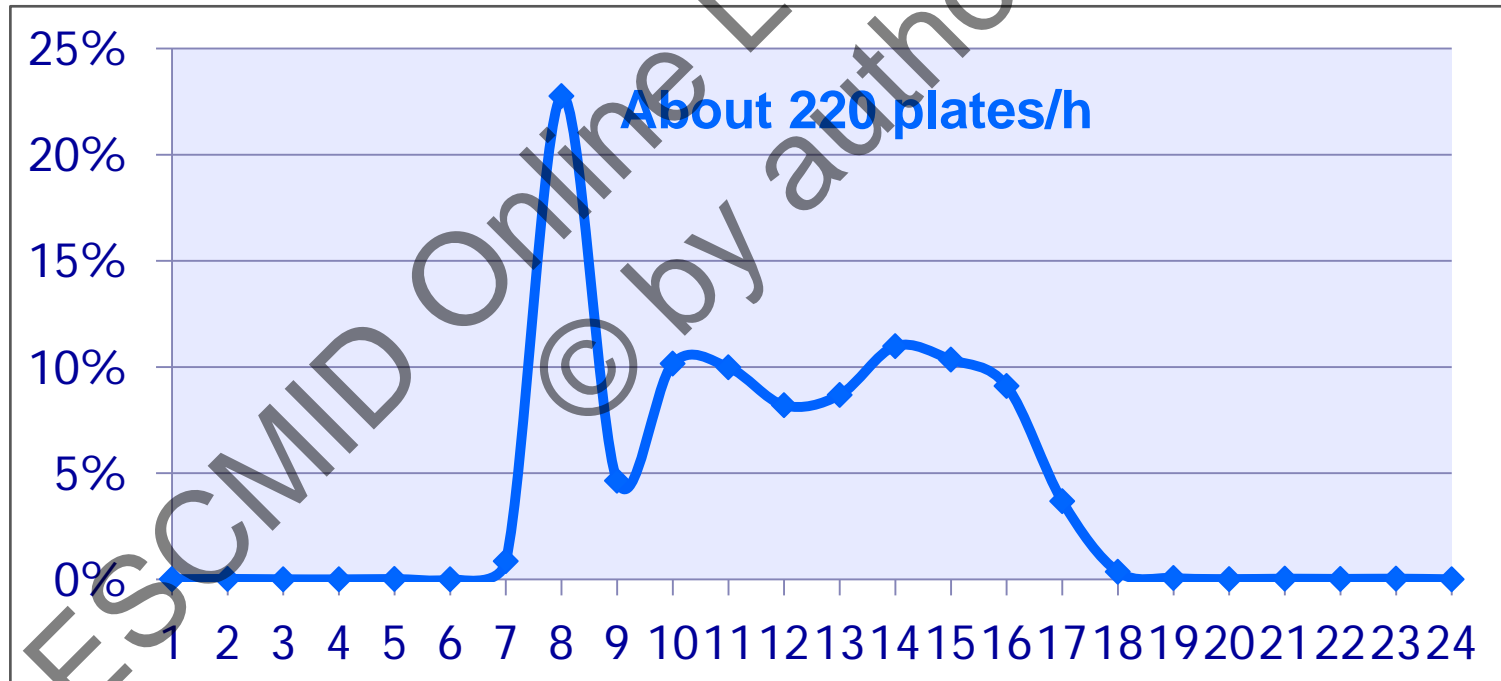
diversity of samples ?

- university hospital
- lab for primary-care physician

2. What inoculation system to choose ?

Characteristics of the lab

- Number of samples processed
1000 plates/day
 - over 24 h = 42 plates/h
 - over 9 h = 111 plates/h



2. What inoculation system to choose ?

Characteristics of the lab

- Number of samples processed
- Variety of inoculated media
- Type of samples received
 - swabs 34%
 - liquid specimen 51%
 - stools 10%
 - tissue specimen 5%

2. What inoculation system to choose ?

Characteristics of the lab

- Number of samples processed
- Variety of inoculated media
- Type of samples received
- Type of container received
- LIS
- Budget
- Space



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Automation in bacteriology

- Semi-automated system for identification +/- antibiotic susceptibility testing (Vitek, Phoenix, ...)
- Automated detection of growth (blood culture, mycobacteria)



Automated inoculation (3rd generation)

Smart incubators

Automated colony picking (MALDI-TOF)

**Integrated thank to
compatibility with LIS**

3. Conclusions

Automation in bacteriology

- Importance of liquid samples
- Importance of IT
 - microbiologists trained in IT
 - LIS + hospital information system
- Importance of compatibility



“we may hope that companies will see the importance of maintaining a high level of compatibility with other systems”

3. Conclusions

Automation in bacteriology

- **Improved quality:**
 - **reproductibility**
 - **rate of isolated colonies**
 - **reduced time to results**
 - **less contamination**
- **Decreased workload**
 - **reduced costs ?**
 - **increased interest for work ?**
- **Risk for small laboratories**

Bacteriology

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Thank you

