

AI as a tool to tackle antimicrobial resistance: ASTapp project

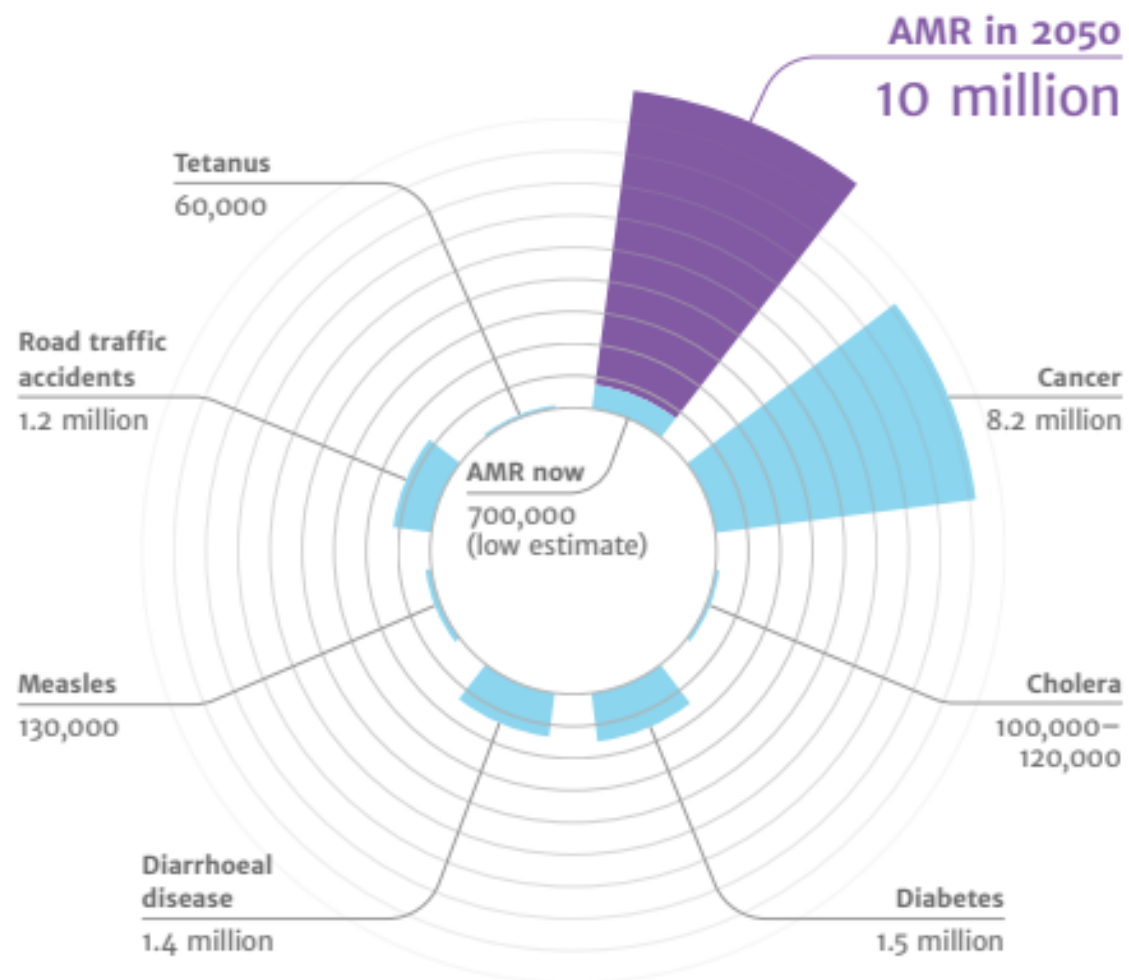
Antimicrobial **S**usceptibility **T**esting **app**lication

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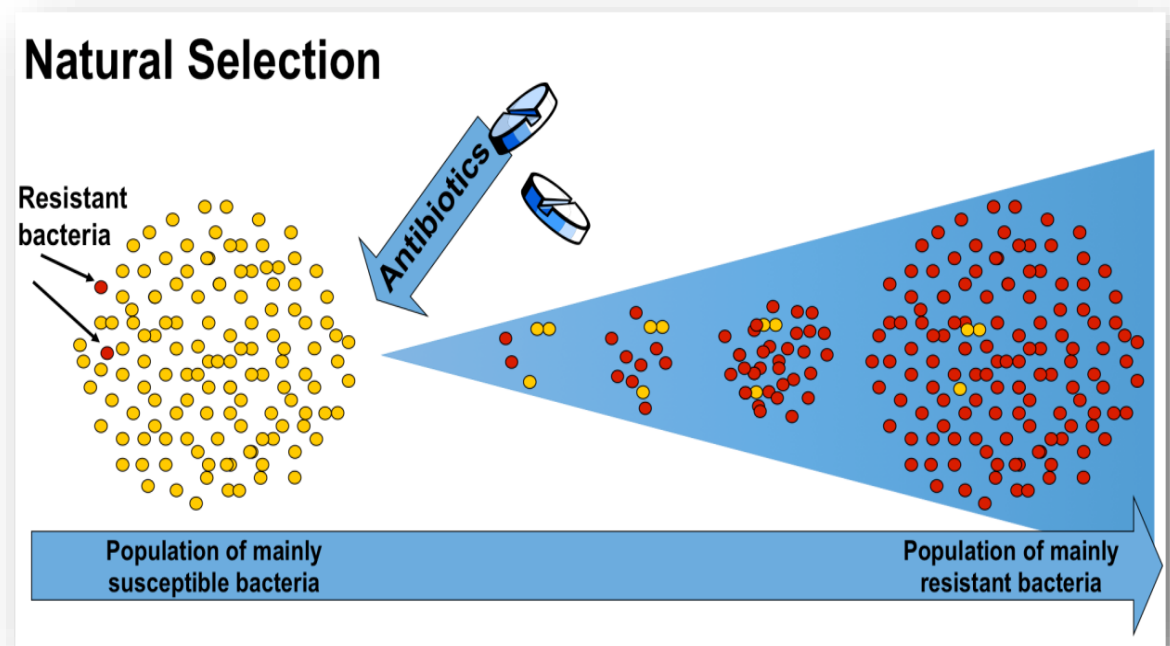
LA FONDATION
Terrain d'innovations.

DEATHS ATTRIBUTABLE TO AMR EVERY YEAR



ABR: Emergence and spread

- Overuse of antibiotics
- Poor IPC
- Lack of Dx tests
- Lack of RD for new ATB



MSF ABR ROADMAP

3 Objectifs:

- Ensure rational use of antibiotics
- Improve Hygiene and infection control
- Improve acces to microbiology Dx tests



Is it a bacterial infection? Which antibiotic can I use?



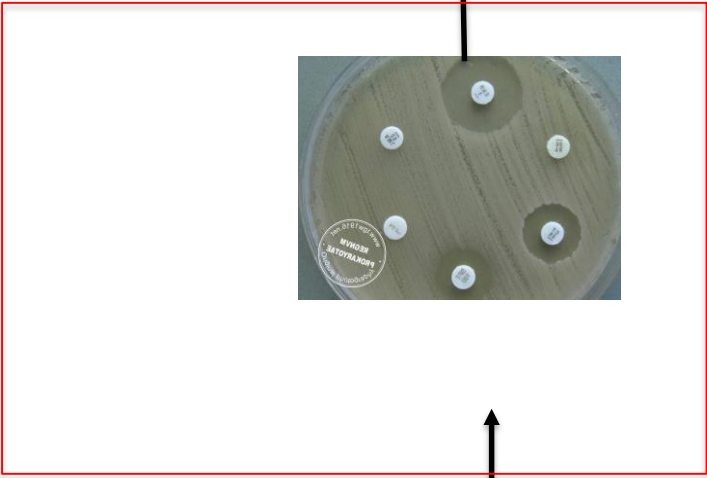
Ceftriaxone is resistant, I need to use Imipenem



Dr prescribes BC



Laboratoire de Bactériologie du
CsREF de Koutiala
Mr..... Numéro patient
Prélevé le 30/08/2018
Résultat: Ecoli
Ampicillin: Résistant
Ceftriaxone Résistant
Imipenem: sensible



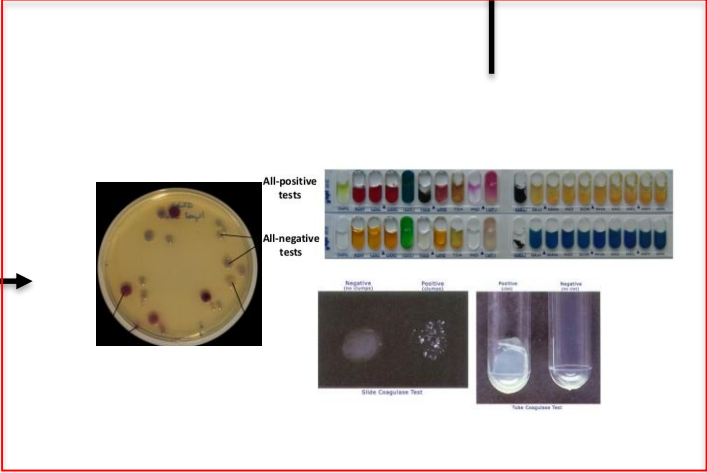
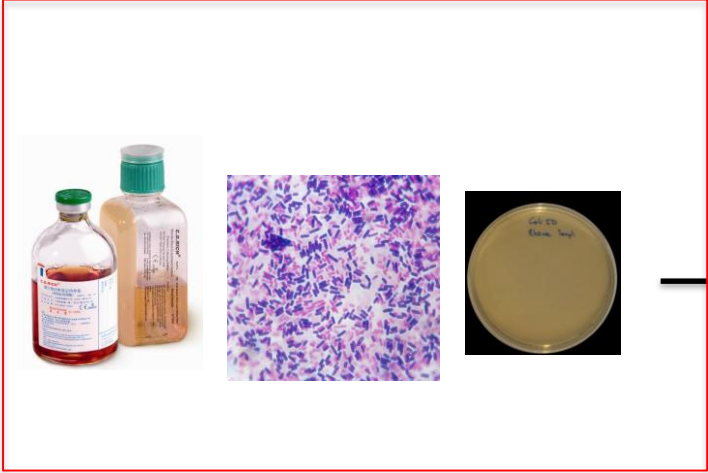
How the lab diagnoses bacterial infection



Sample sent to the lab



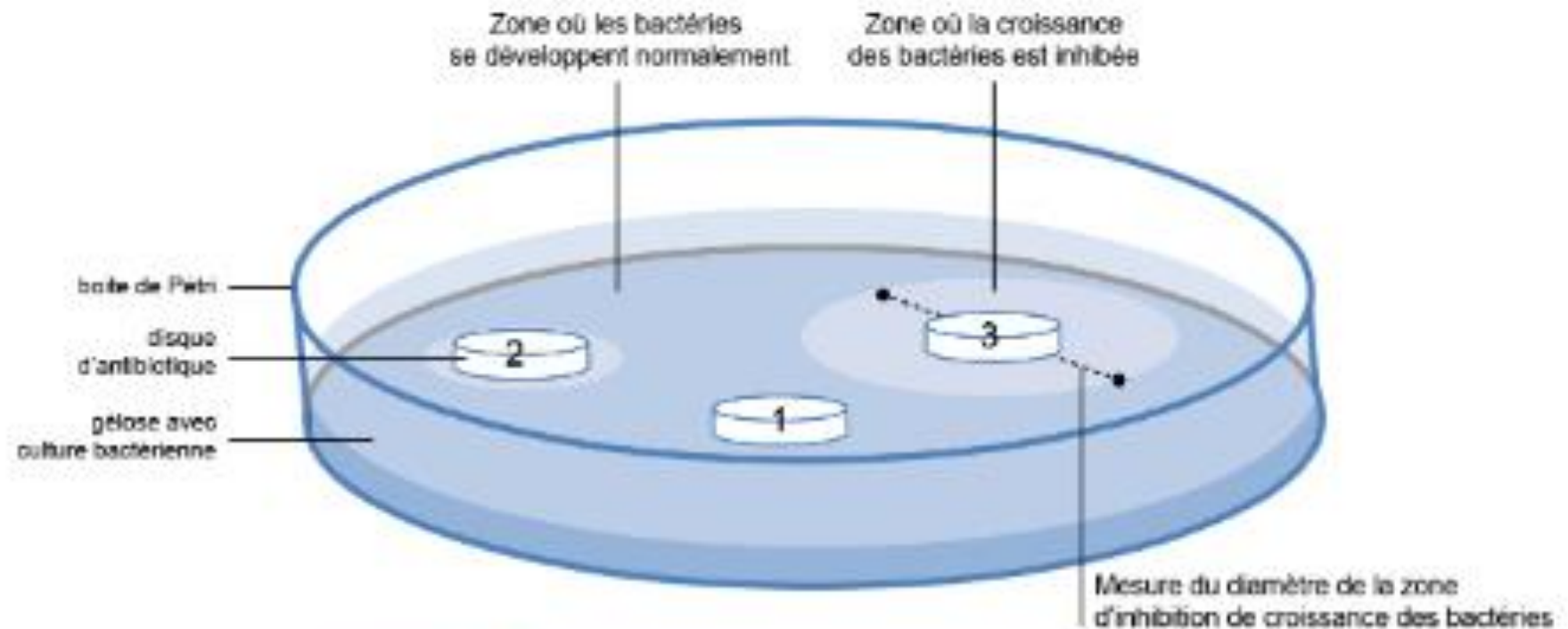
Incubation



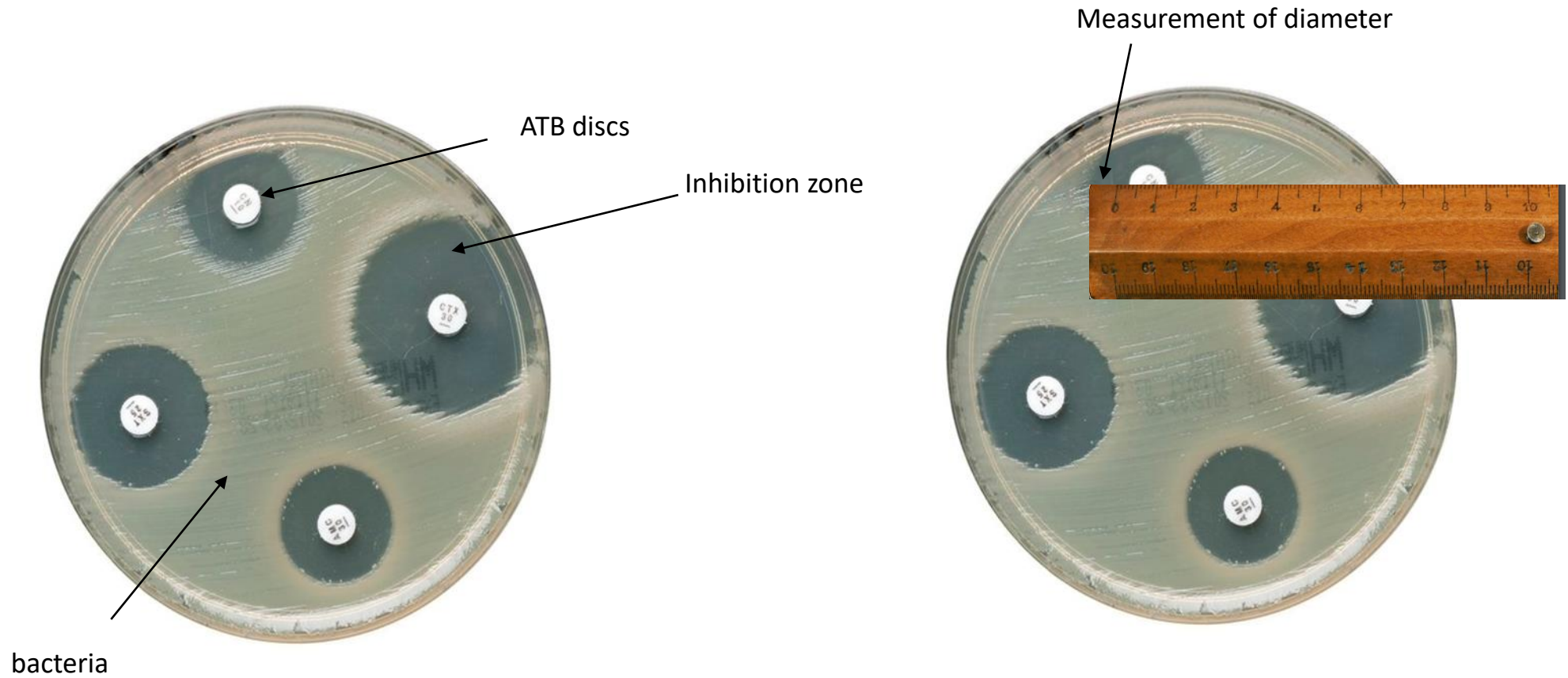
The antibiogram: AST



The antibiogram: AST



Reading an antibiogram



The interpretation of an antibiogram

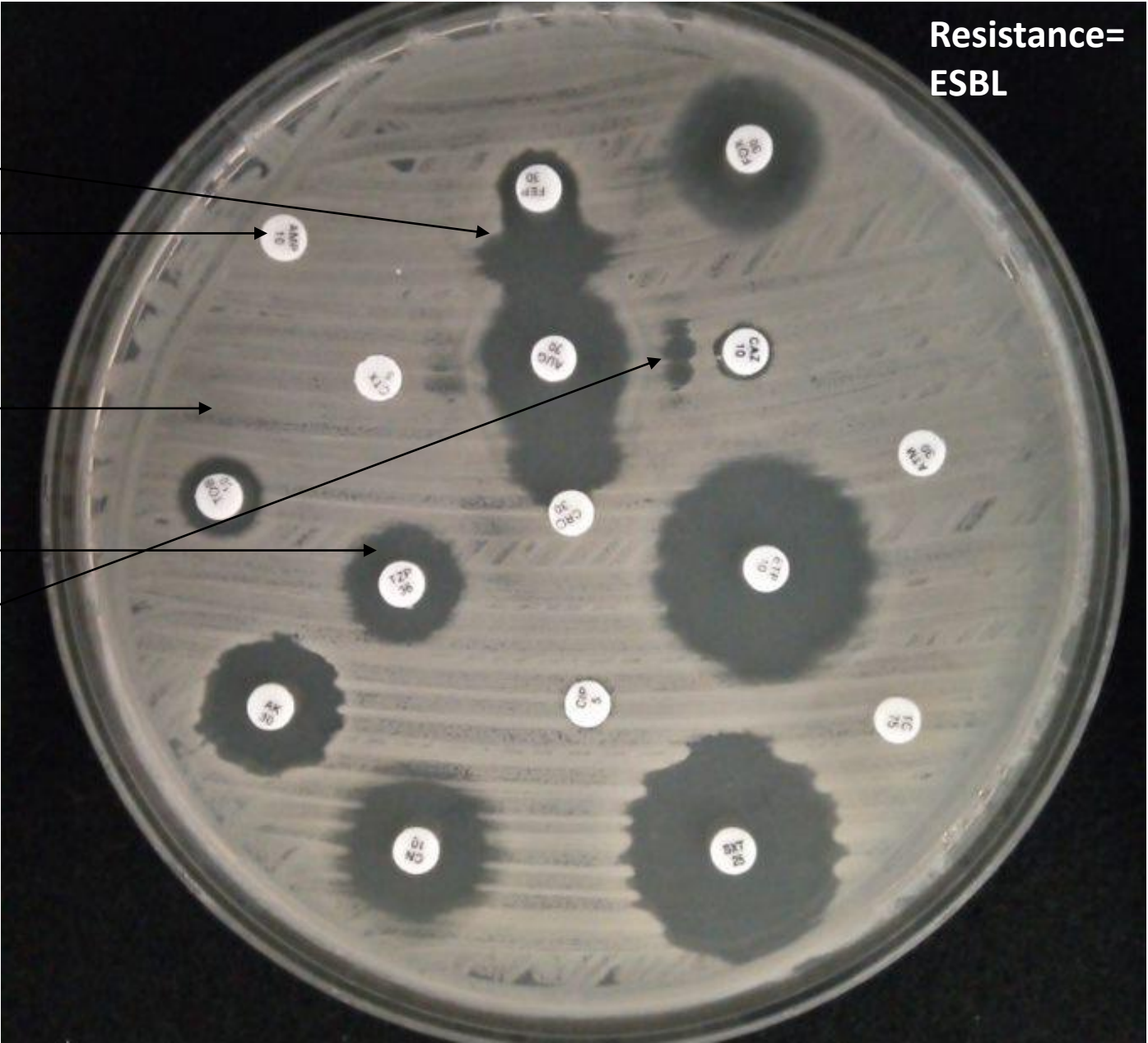
Synergy shape

Antibiotic discs

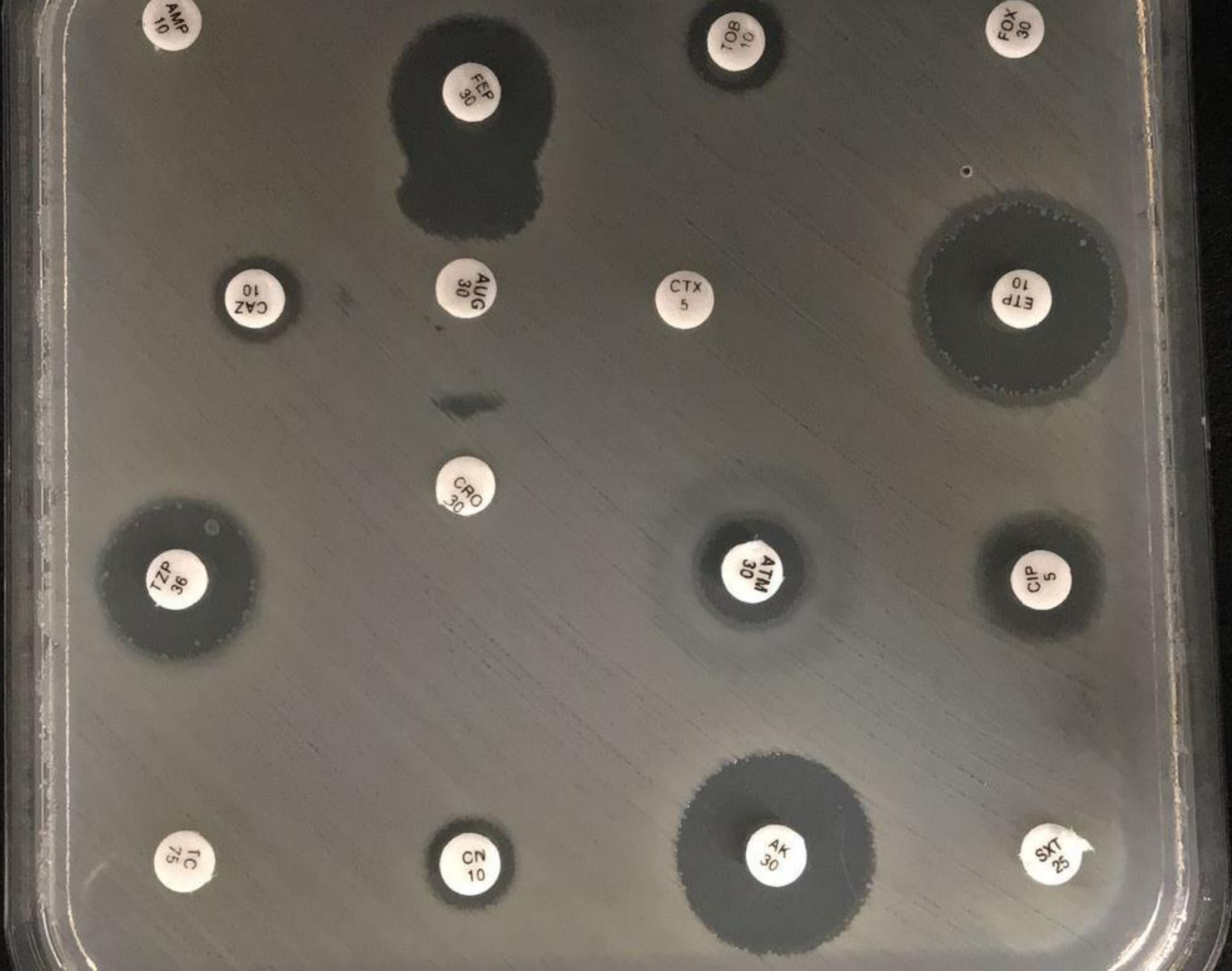
Bacteria layer

Inhibition zone

Synergy shape

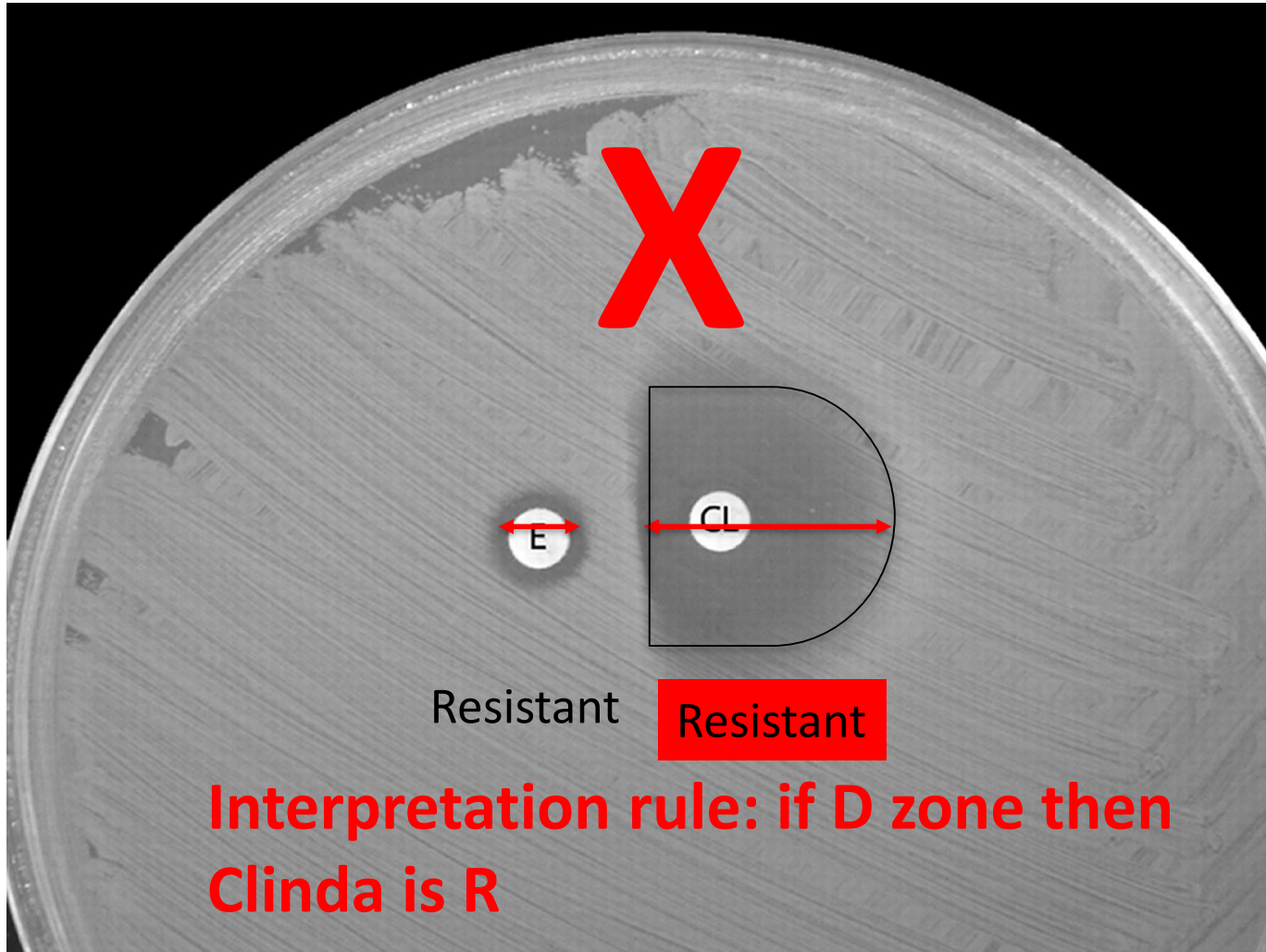


The interpretation of an antibiogram

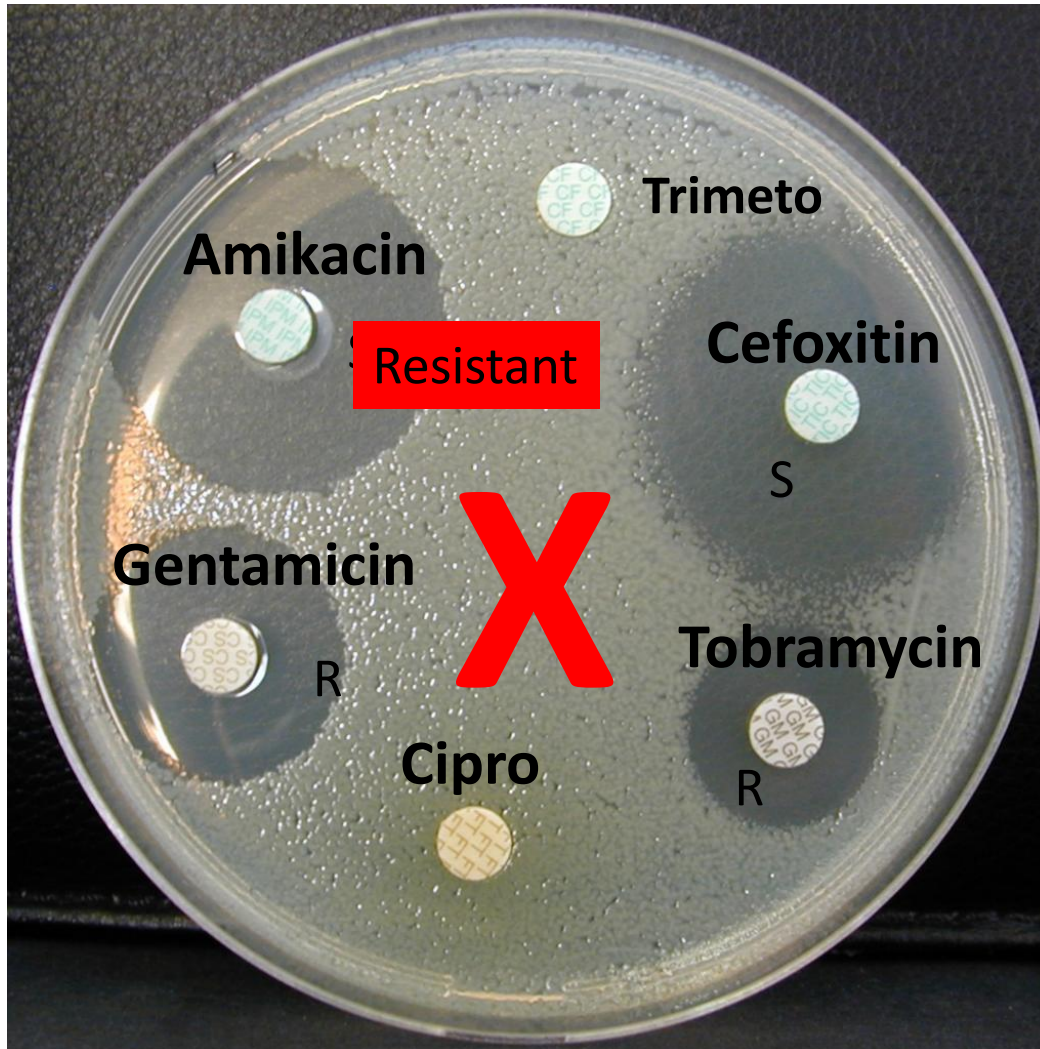


Resistance=
ESBL

The interpretation of an antibiogram



The interpretation of an antibiogram



Interpretation rules:

If Tobra R , so Amikacin R

For Staphylococcus aureus infection : Cloxa

Where is cloxa?

Rules: If Cefoxitin S =Cloxa S

Staphylococcus aureus

What is the problem in LMIC?

- Short technical training +/- simple (Few weeks/months)
- Longer time for interprétation training
- Need for expert
- Risk : give back wrong antibiogram/wrong treatment for patients

Existing solution in dev countries

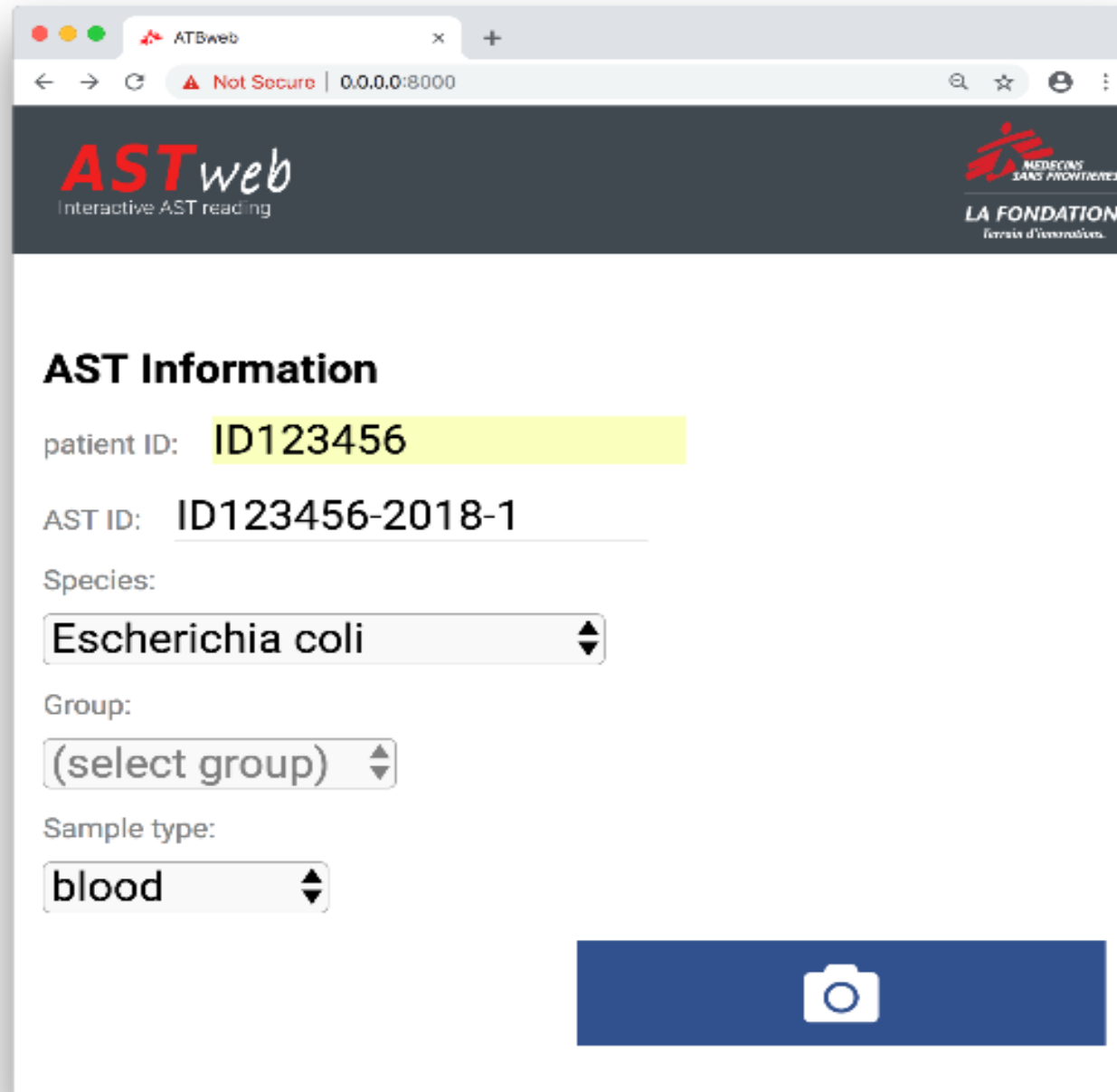
- 20 000 to 30 000 Euros
 - Maintenance
 - Online
 - No automatic recognition of resistance mechanisms
- => Not adapted to our contexts



ASTAPP

- Automatic measurement of diameter
- Interpretation based on international rules
- Extrapolation to antibiotics that are not tested
- Identification of resistance mechanisms
- Alert when AST is not matching with identification
- Self training: each step is explained with some reference for more details
- Offline
- Gives advices on treatments based on MSF protocol
- Reporting/ analysis: Hospital cumulative AST

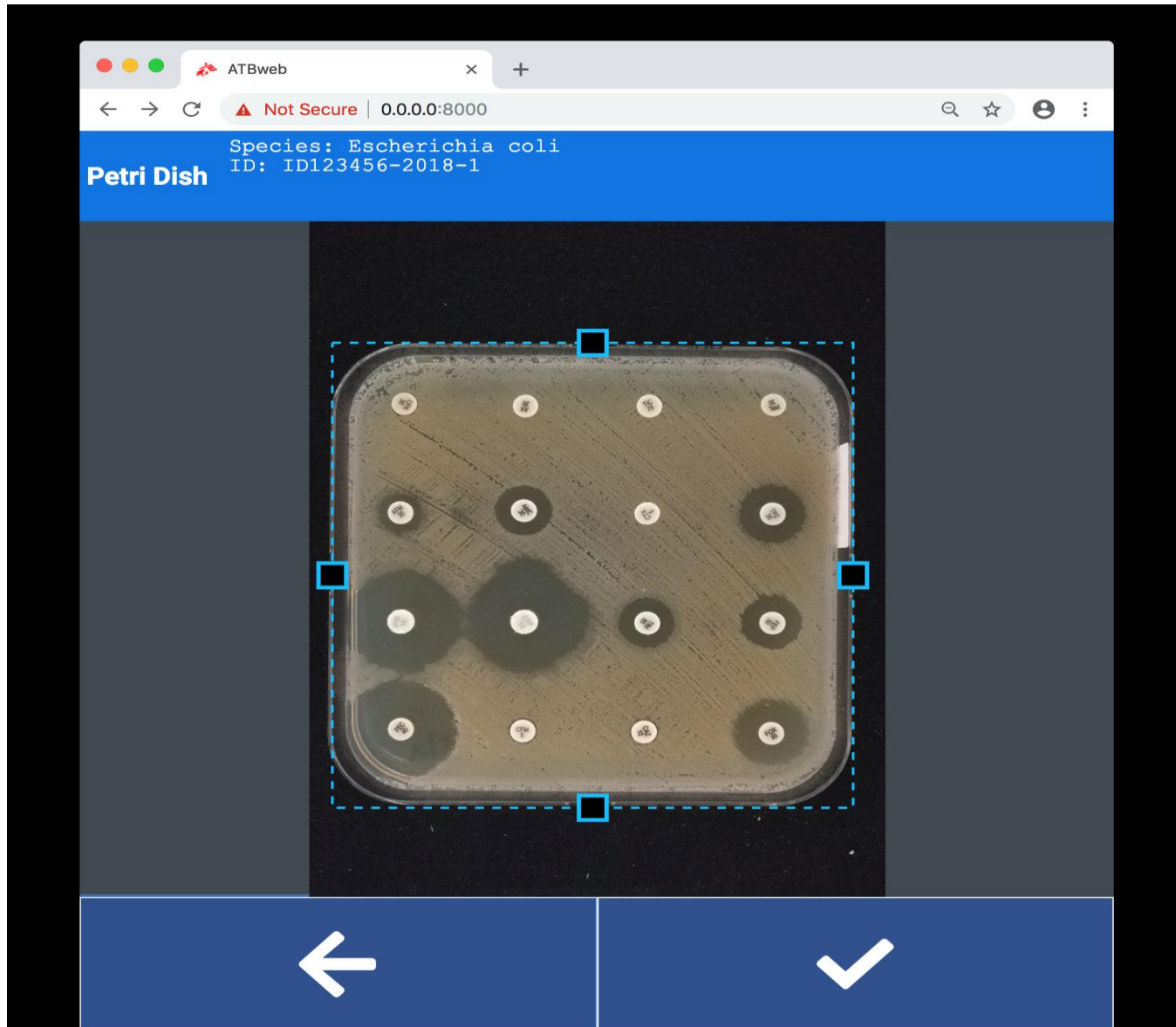
ASTapp



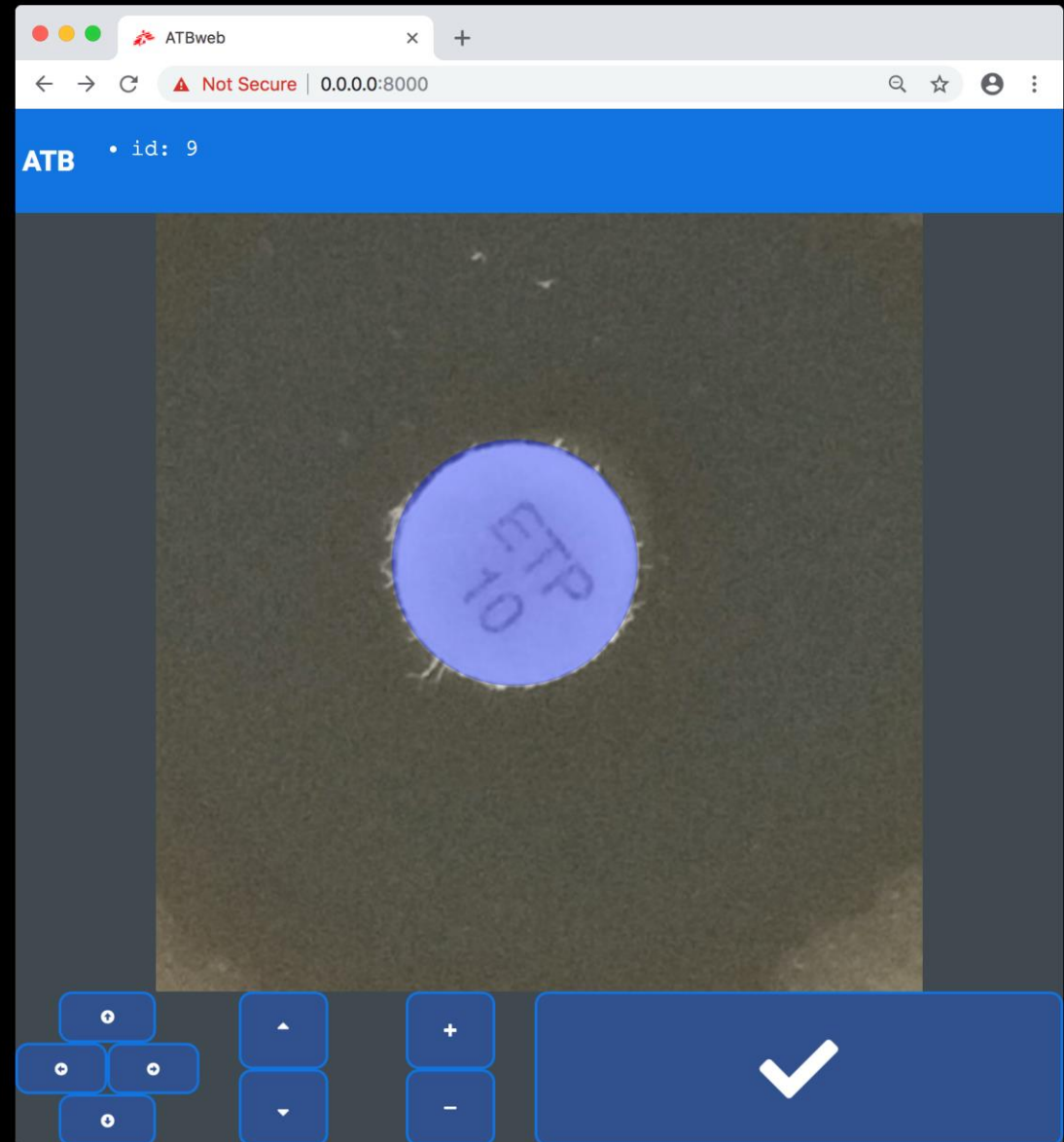
The screenshot shows a web browser window with the following elements:

- Browser Tab:** ATBweb
- Address Bar:** Not Secure | 0.0.0.0:8000
- Header:**
 - Left: **ASTweb** Interactive AST reading
 - Right: **MEDECINS SANS FRONTIERES LA FONDATION** Levens d'Innovation.
- Section Header:** **AST Information**
- patient ID:** ID123456
- AST ID:** ID123456-2018-1
- Species:** Dropdown menu showing **Escherichia coli**
- Group:** Dropdown menu showing **(select group)**
- Sample type:** Dropdown menu showing **blood**
- Action:** A blue button with a camera icon, likely for image upload.

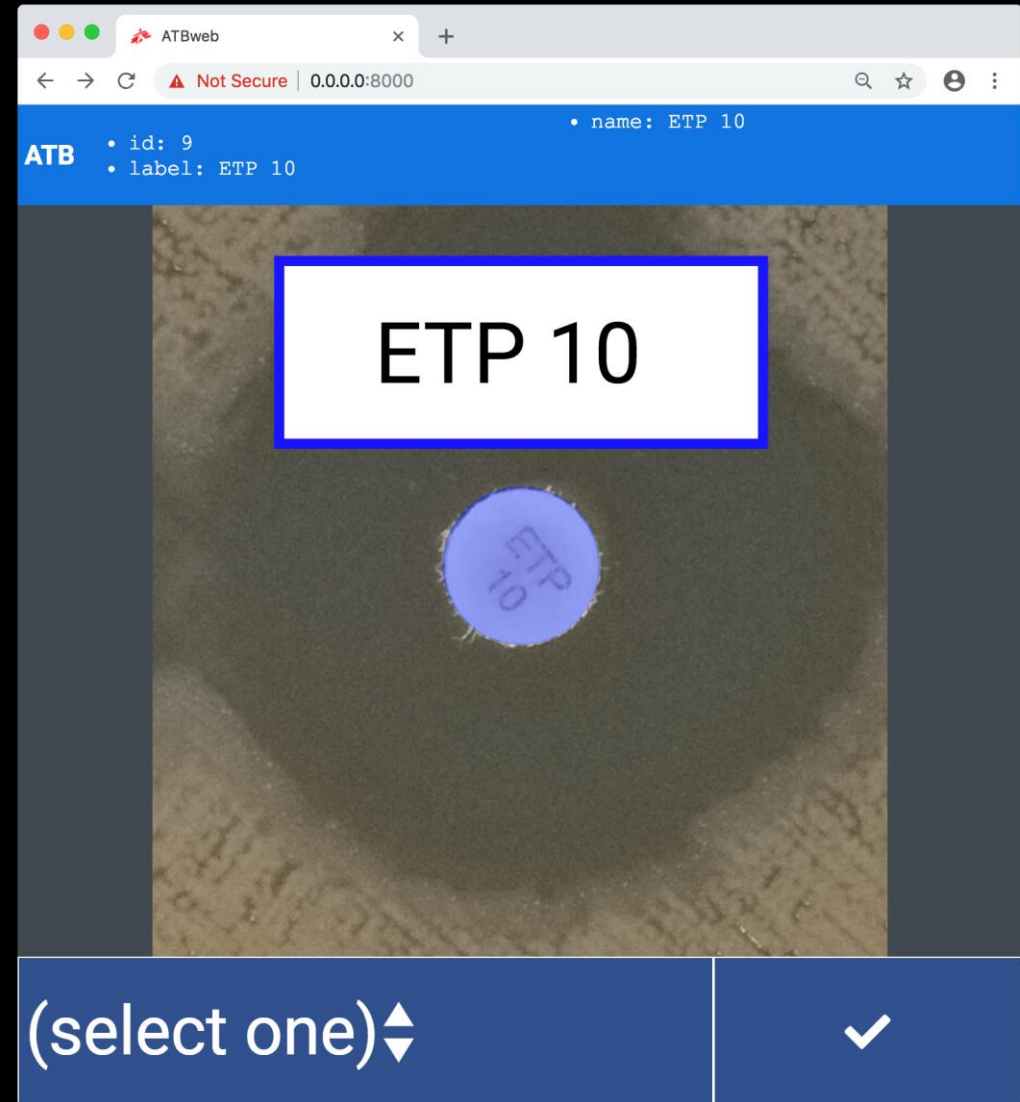
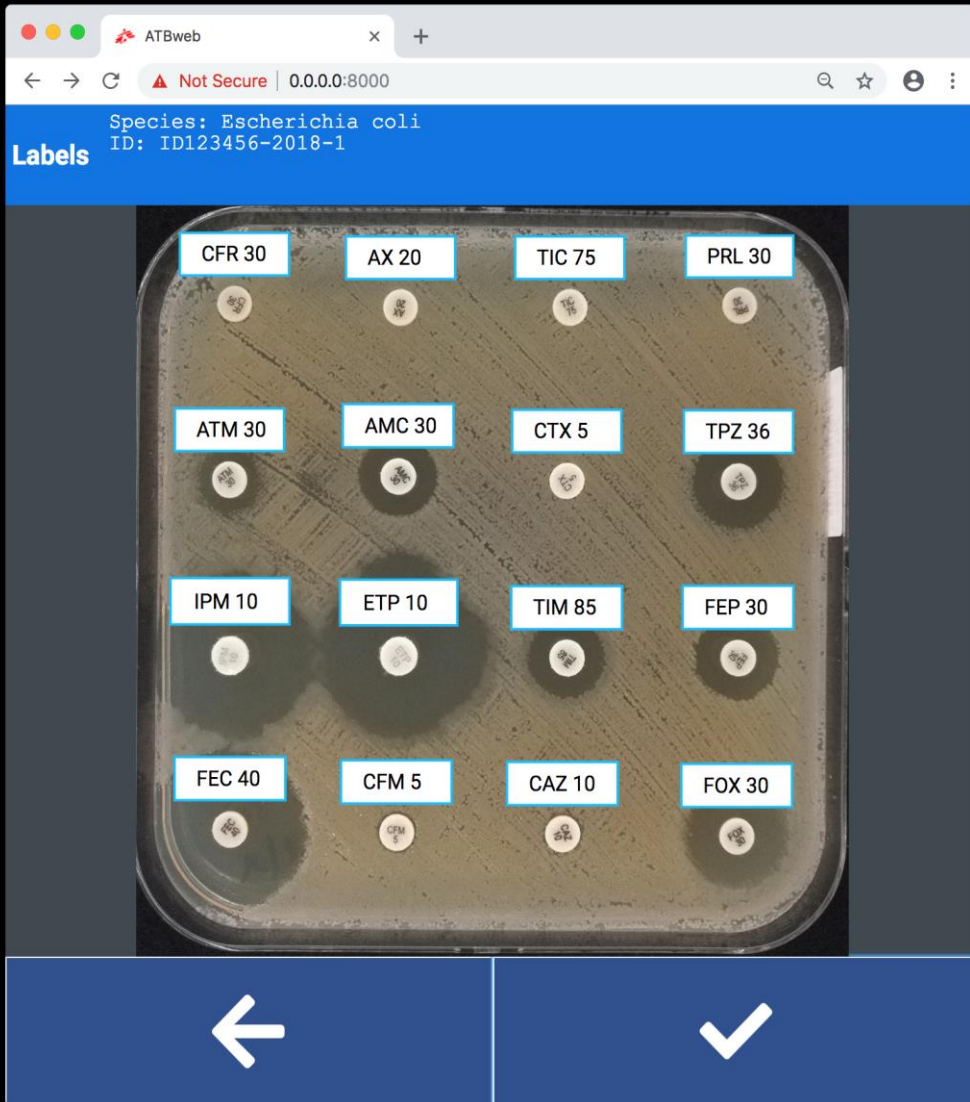
1. Identification of the Petri dish



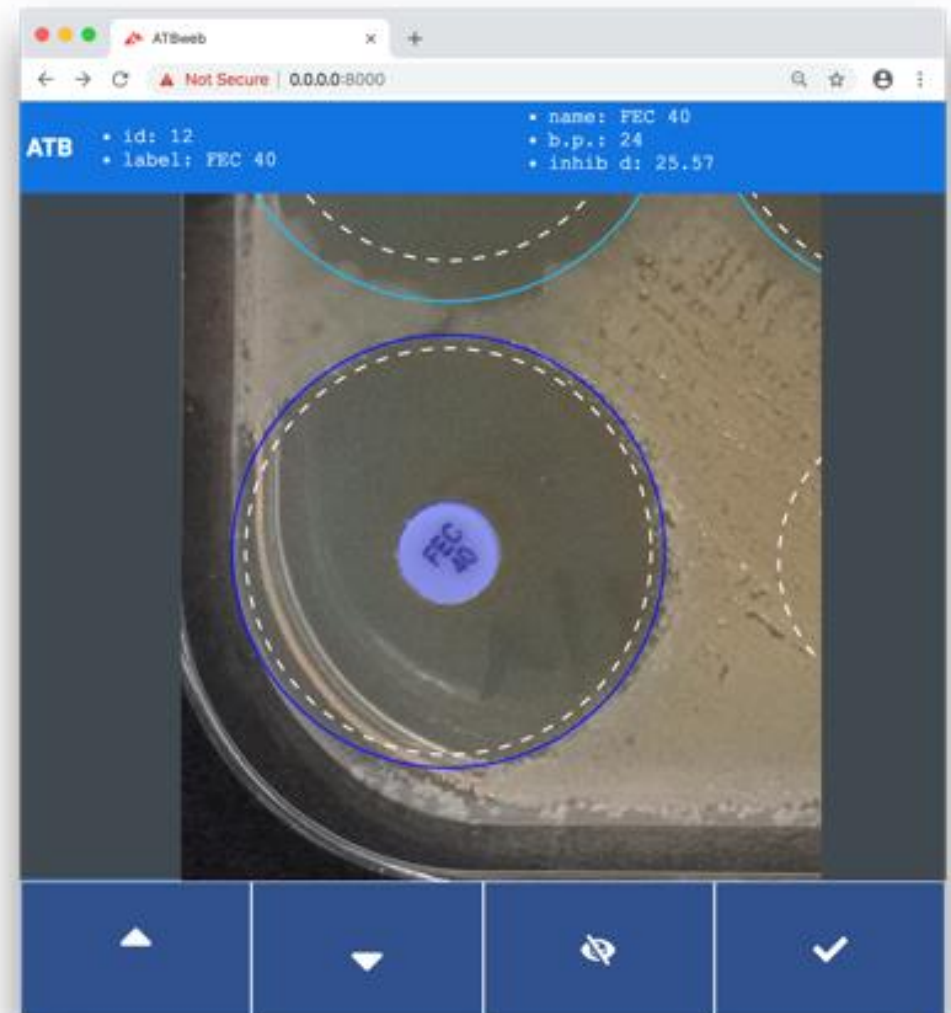
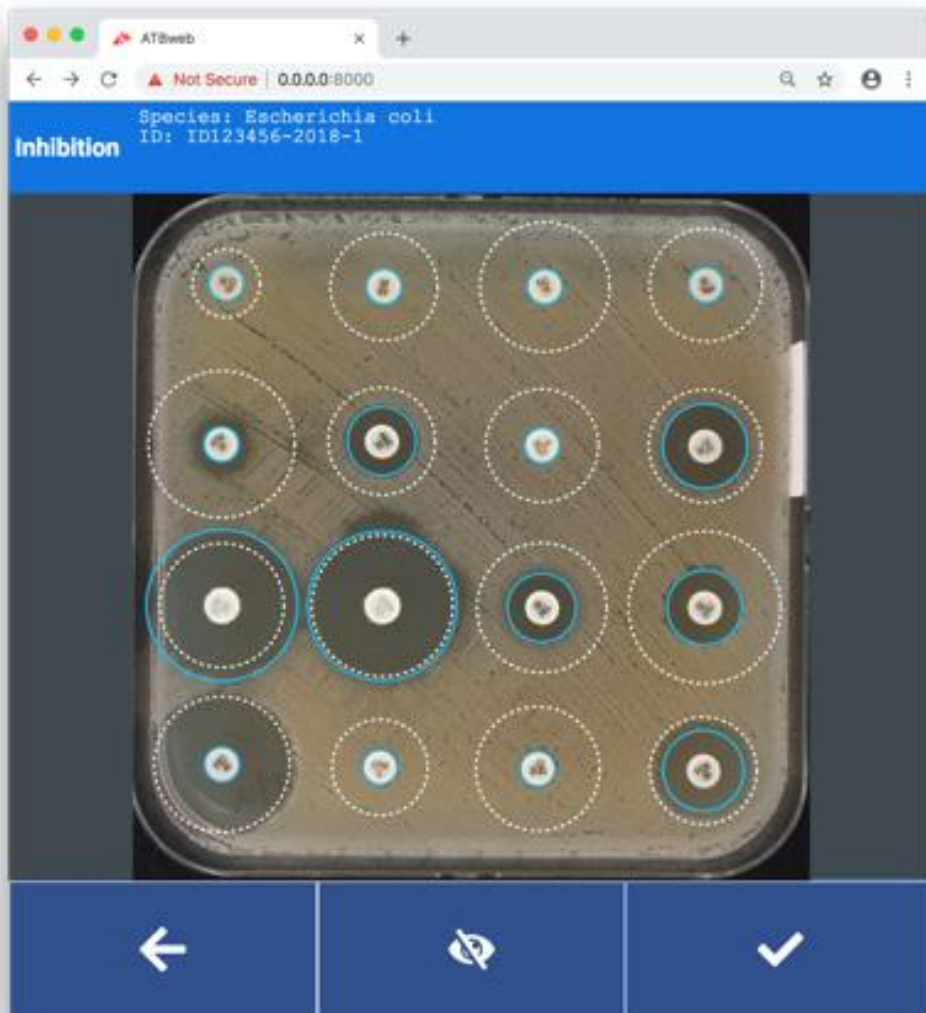
2. Identification of antibiotics discs



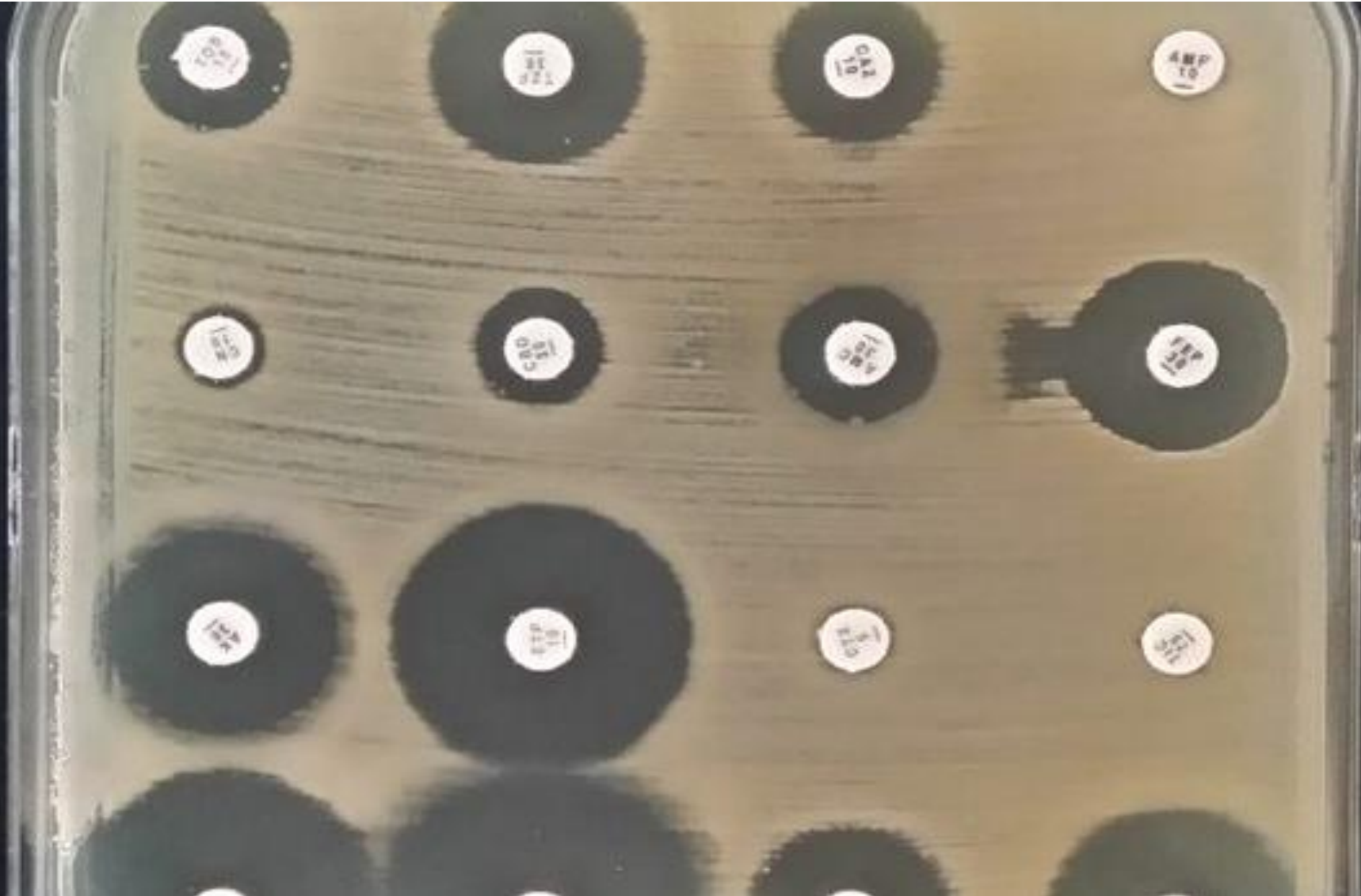
3. Reading the name of atb discs



4. Measurement of the diameter and application of expert rules



5. Automatic identification of resistance mechanism



6. Display of results

Species: *Escherichia coli*
ID: ID123456-2018-1

Interpretation

Raw result:

Antibiotique	diam [mm]	SIR
CEFADROXIL 30µg	6	Resistant
AMOXICILLINE 20µg	6	Resistant
TICARCILLINE 75µg	6	Resistant
PIPERACILLINE 30µg	6	Resistant
AZTREONAM 30µg	6	Resistant
AMOXICILLINE + AC.CLAVULANIQUE 20-10µg	12	Resistant
CEFOTAXIME 5µg	6	Resistant
PIPERACILLINE + TAZOBACTAM 30-6µg	15	Resistant
IMIPENEME 10µg	27	Susceptible
ERTAPENEME 10µg	26	Susceptible
TICARCILLINE + AC.CLAVULANIQUE 75-10µg	12	Resistant
CEFEPIME 30µg	13	Resistant
CEFEPIME + AC.CLAVULANIQUE 30-10µg	26	Susceptible
CEFIXIME 5µg	6	Resistant
CEFTAZIDIME 10µg	6	Resistant
CEFOXITINE 30µg	14	Resistant

Interpreted result:

Antibiotique	SIR
PENICILLINES-G	Resistant
AMINOPENICILLINES	Resistant
CARBENICILLINE 100µg	Resistant
ACYLUREIDOPENICILLINES	Resistant
PENICILLINES-M	Resistant
CEPHALOSPORINES 1 st GENERATION	Resistant
CEPHALOSPORINES 2 nd GENERATION	Resistant
AMOXICILLINE + AC.CLAVULANIQUE (CYSTITES)	Resistant
PENICILLINE G 1U	Resistant
OXACILLINE 5µg	Resistant
LINCOSAMIDES	Resistant
STREPTOGRAMINES	Resistant