

# THE.WAVE.TALK

THE STARTUP WHO SAVED THE MOST LIVES ON EARTH

August, 2020

Prepared by THE.WAVE.TALK



THE.WAVE.TALK

# Company Overview

## ■ Company Summary

-THE.WAVE.TALK has developed a technology that can **rapidly** and **precisely detect** foreign substances including bacteria in liquid.

-THE.WAVE.TALK has developed smart IoT water sensors. General consumers can use **“SensCup”** to check water quality (turbidity) at home. Governments can use **“SensModule”** to check water turbidity in water pipeline system.

-THE.WAVE.TALK has also developed IVD/QC devices. **“Bacometer\_AI”** enables cost-effective, fast, and automated bacteria detection in various settings including Urinary Tract Infection (UTI) diagnosis. **“Fast Agar Reader”** reduces Antibiotic Susceptibility Test (AST) time on agar plate.

## ■ Technology Introduction

**Microscopic Precision & Large Area (Volume) Test**

**= Quantification & Qualification of Data**

### **Core Technology**

Fast detection/identification of bacteria inside liquid using patented CSMS (Chaotic Scattering Material and Structure) and our patented software

# Team Members | TOP Management

CEO

**YoungDug Kim**

“Serial Entrepreneur in  
Hardware Start-ups”



- Visiting Scholar at Lehigh University
- Serial Entrepreneur
- LGChem Researcher
- Technology Export to Dow Chemicals
- Collaborative research with and delivery to Google, Apple, Samsung, LG, Sony Ericsson

Co-Founder

**YongKeun Park**

“Serial Entrepreneur Who Makes  
Actual Products From Physics Theories”



- PhD at Harvard-MIT
- KAIST Physics Professor
- American optical society fellowship
- TOP3 Young Korean Scholar, 2016
- Hong Jinki Creative Person Award, 2018
- KAIST Person Of The Year, 2018

# Patents



**PATENT I .**  
**NO.10-2016-0028966**

Apparatus and Method for  
Detecting Microbes or  
Bacteria



**PATENT II.**  
**NO. 15/170508**

APPARATUS AND METHOD  
FOR DETECTING MICROBES  
OR BACTERIA



**PATENT III.**  
**NO.10-2016-0151230**

Packaging container for  
detecting the presence of  
microorganisms, system for  
detecting the presence of  
microorganisms including  
the same and method for  
detecting the presence of a  
microorganism using the  
same



**PATENT IV.**  
**NO.10-2017-0116666**

System for detecting  
microorganism in fluid with  
chaotic sensor

## Registered Patents

1	16.12.18	제10-1686766호
2	17.11.27	제40-1307256호
3	17.11.27	제40-1307257호
4	18.06.19	US 10,001,467 B2
5	18.11.15	제10-1920852호
6	19.01.11	제10-1939779호
7	19.03.11	제10-1959023호
8	19.04.16	제10-1971272호

**Protection of TWT technology and  
Prevention of competitors  
entering our target market  
through TWT's patents for CSMS  
that detects bacteria in real-time**

## ~'17 Patent Application

1	10-2015-0160915
2	10-2016-0068563
3	16172885.2
4	10-2016-0090961
5	10-2016-0092901
6	10-2016-0120764
7	10-2016-0093466
8	10-2016-0132149
9	10-2016-0144640
10	10-2016-0152973
11	PCT/KR2016/013288
12	PCT/KR2017/005747
13	10-2017-0145581
14	10-2017-0168482

## '18 Patent Application

15	15776584
16	16866671.7
17	2018-526645
18	10-2018-0057326
19	10-2018-0077193
20	201680079041.1
21	10-2018-0107292
22	PCT/KR2018/013164
23	16/184677
24	2019-515755
25	16/305982
26	PCT/KR2018/015478
27	201780034467.X

## '19 Patent Application

28	17807037.1
29	17807037.1
30	10-2019-0033955
31	10-2019-0009807
32	10-2019-0009808
33	10-2019-0029902
34	10-2019-0045142
35	10-2019-0057747
36	PCT/KR2019/005944
37	10-2019-0081530
38	10-2019-0057746
39	16/492,577
40	PCT/KR2019/011559

# Awards And Media Recognitions

## ■ BEEN RECOGNIZED BY BOTH COMMERCIAL AND SCIENTIFIC ORGANIZATIONS

2017	Hello Tomorrow TOP7 (Out of 3,000 applicants, Food & Agriculture track)	
2017	Beyond TIPS Grand Prize (By Korean Ministry of ICT)	
2018	<b>TOP7 PATENTS AWARD</b> (Korea Intellectual Property Office)	
2018	2 <sup>nd</sup> Prize at RESI Innovation Challenge (US biotech startup competition)	
2018	TOP3 Imagine H2O Urban Water Challenge (Asia Track)	
2018	Next Generation Unicorn Company (Korea Venture Investment Corp)	
2019	<b>WATER INDUSTRY INNOVATION AWARD</b> (The Ministry of Environment)	
2019	D.DAY & IFC Competition Winner (D.DAY & International Finance Corporation)	
2019	PITCH@PALACE KOREA PEOPLE'S CHOICE AWARDS	
2019	Future Food Asia Top10	
2020	<b>CES INNOVATION AWARD</b>	

### THE.WAVE.TALK receives Innovation Award at CES 2020

Portable smart IoT water sensor technology - the first B2C product presented at CES by THE.WAVE.TALK - named award honoree

NEWS PROVIDED BY  
Born2Global Centre  
Nov 11, 2019, 08:30 ET

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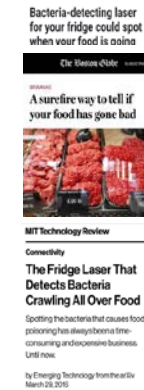
SEOUL, South Korea, Nov. 11, 2019 /PRNewswire/ -- THE.WAVE.TALK, a member company of the Born2Global Centre, was named a CES Innovation honoree in the Home Appliances category at CES Innovation Awards 2020 for its smart IoT water sensor.

CES, which is held annually in Las Vegas, is the world's largest IT trade show. Each year, CES gives out Innovation Awards in various categories; awards are given based on the standards of technology, design, and consumer value.



Using the technology it received from KAIST via an official technology transfer, THE.WAVE.TALK developed a smart IoT water sensor that is smaller and cheaper than existing turbidity meters. Developed based on the principles of light, the sensor is over 10 times more sensitive than the average turbidity meter. It uses tens or hundreds of thousands of laser refractions to detect not only foreign substances but even invisible bacteria.

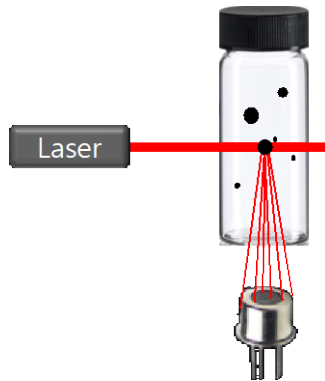
THE.WAVE.TALK's new sensor is over five times smaller than the average turbidity meter, making it easy to



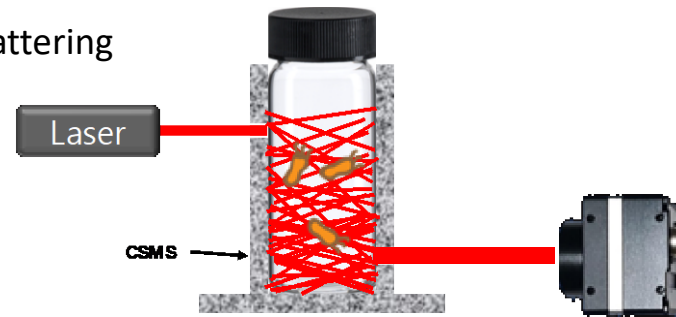
# TWT TECHNOLOGY | COMPARISON

- It is difficult to detect signals of small microorganism through Mie Scattering
- Chaotic Scattering can detect **signals of small microorganism** because it amplifies the signal.

MIE scattering



Chaotic scattering

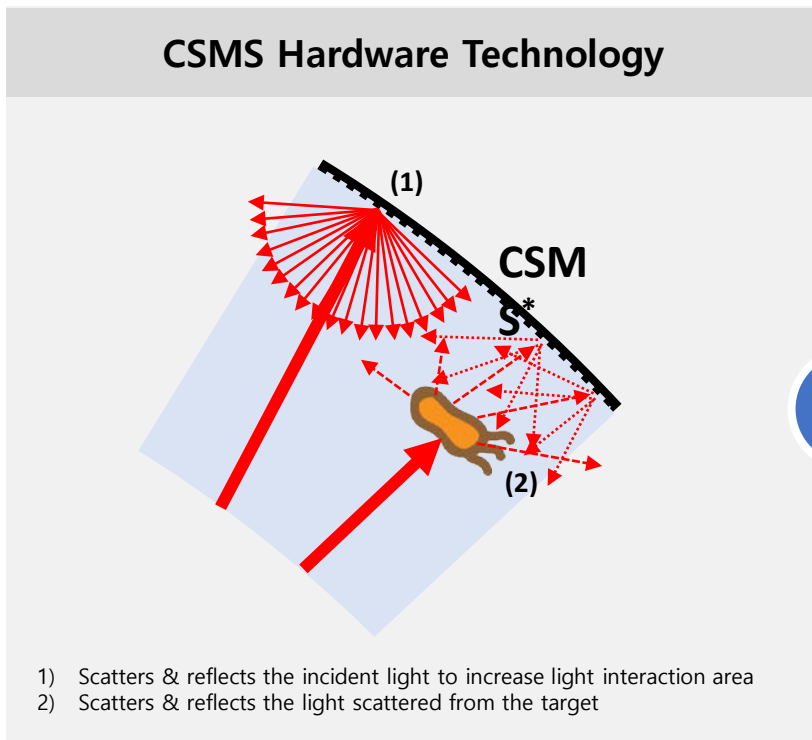


Sensor schematic

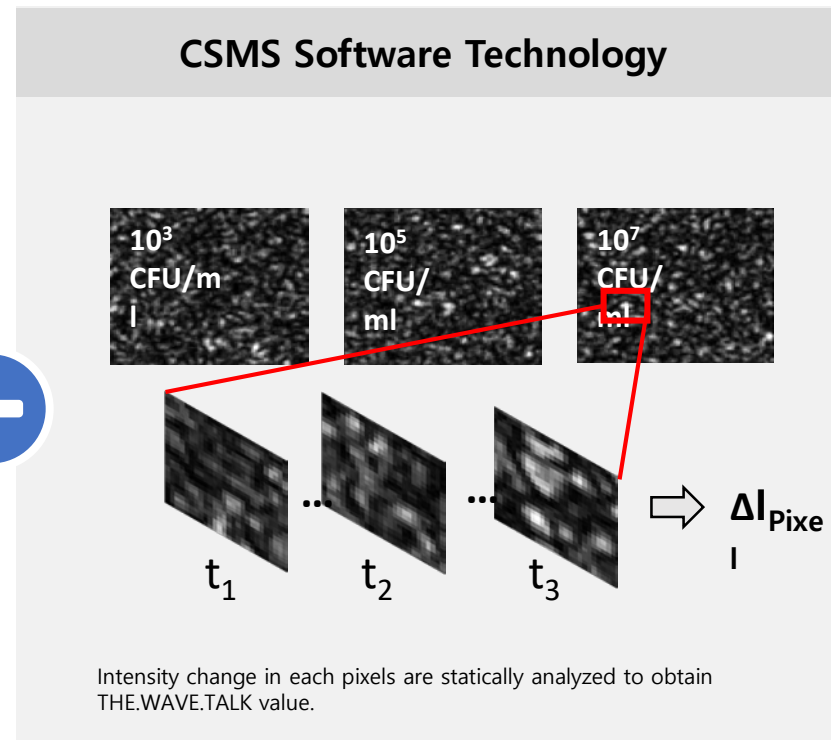
<p>Simple Side Scattering Going through particles once</p>	<p>Multiple scattering Going through particles multiple times → <b>Increase in Signal-to-noise</b></p>
<p>Using Photodiode Analyzing <b>Intensity</b></p>	<p>Using CMOS camera Analyzing <b>Phase</b></p>
<p>Detect whether particle exists or not Detect how big it is</p>	<p>Detect whether particle exists or not Detect how big it is Detect whether it is moving</p>

# TWT Technology: Signal Amplification (HW) + Image Analysis (SW)

- Signal amplification hardware technology through CSMS based on chaotic scattering
- Software technology that analyzes pattern change through time correlation coefficient analysis



- Scattered light by light inside the CSMS significantly increases the interaction between light and particle



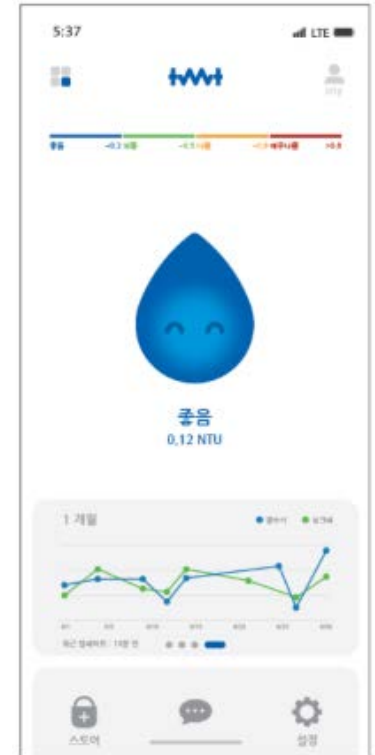
- Quantify the information about particle motility and increase

# Product - SensCup (Launching in October 2020)

## ■ Smart IoT Sensor For Everyone



Spec item	Detail
Detection Method	CSMS
Detection Range	0 ~ 5 NTU
Laser Class	Class 3B
Size	110*130*65mm (without a cup)
Weight	0.3kg
Power	5VDC / 2A
App	Android / IOS
Estimated Price	\$100

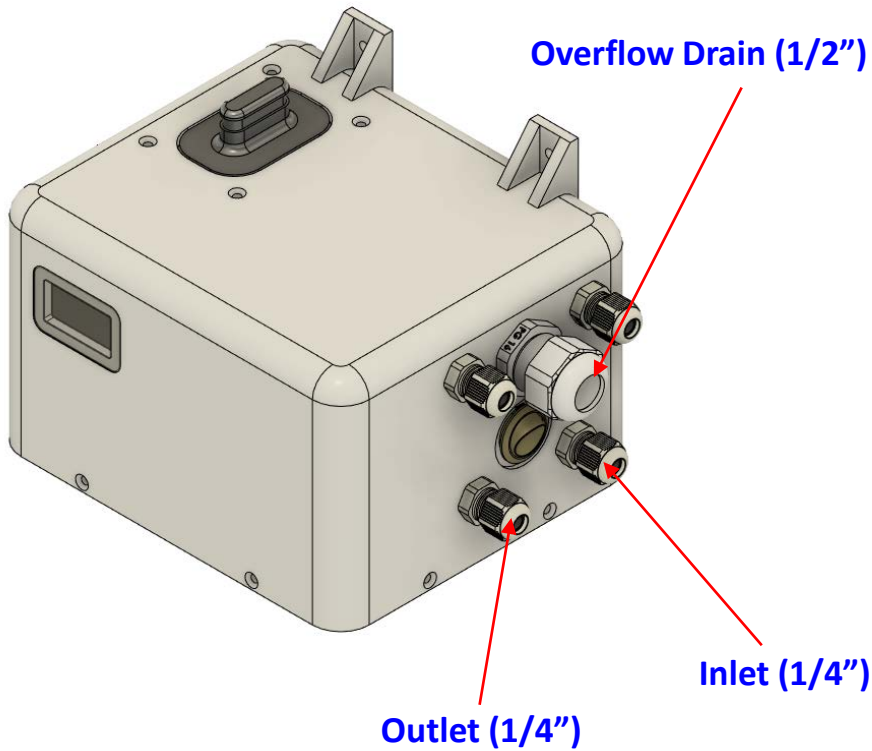


**SensCup** allows anyone to **easily test their water quality in 15 seconds** and get **water quality information on the mobile app.**





# Product – SensModule (Prototype)



Item		Detail
1	Detection Method	CSMS
2	Detection Range	0 ~ 5 NTU
3	Detection Interval	Min 1 min.
4	Size (W*D*H, mm)	175 * 150 * 125mm
5	Weight (kg)	2.2kg
6	Power	220V
7	Temperature	5°C ~ 35°C
8	Laser class	Class 3B
9	Inlet/outlet/Overflow Drain Pipe Size (inch)	¼" (2ea) / ½" (1ea)
10	Data Transfer	RS232 / wifi

# Product – BACOMETER



Bacometer Prototype



Bacometer\_AI (Product Development In Progress)

## Product Advantages

- ◆ **Rapid detection**  
Rapid detection of bacteria inside liquid
- ◆ **No pretreatment**  
Non-expert can easily use this device
- ◆ **Cut down labor costs**  
Data can be collected and managed digitally

## Application Areas

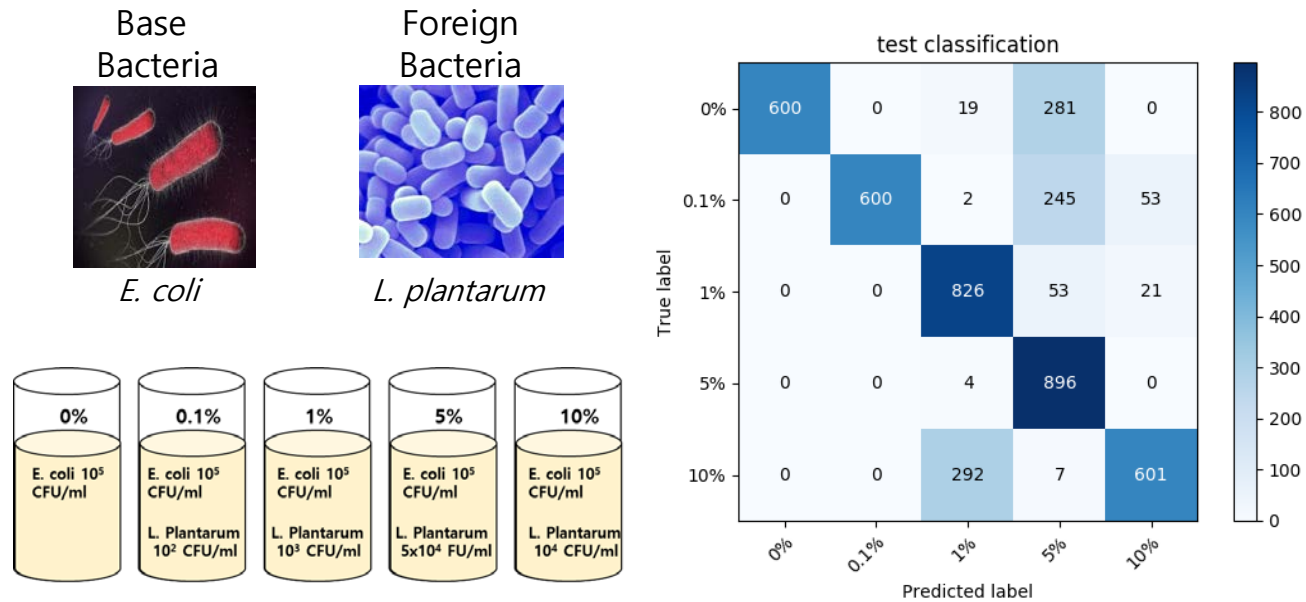
- ◆ UV efficacy test
- ◆ Bacteria contamination test
- ◆ Antibiotic Susceptibility Test (AST)
- ◆ Urinary Tract Infection (UTI) test

# Project In progress: Detecting Bacteria Contamination (Joint research with a company in Korea)

Companies mass-cultivate single bacteria species in order to produce amino acid

Heterogeneous bacteria contamination can happen, and it takes more than 1 day to detect this. Only ex post measures are possible.

Using TWT device analyzing speckle images, we can detect heterogeneous bacteria contamination within 30 minutes.



# Project In progress: Clinical Test In Progress For Early Detection Of Urinary Tract Infection

Most important things in urinary tract infection diagnosis are 1) quickly finding out gram positive / negative and 2) prescribing appropriate antibiotic

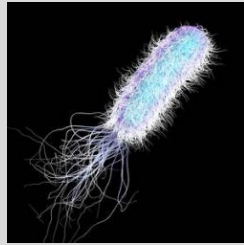
We can find out gram positive / negative within 30 minutes.

Currently, we are doing clinical tests with one university hospital in Korea.

Gram  
Negative



E. coli

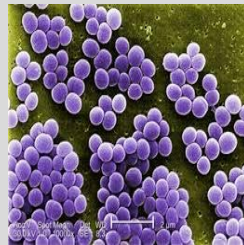


P. aeruginosa

Gram  
Positive



B. subtilis



S. aureus

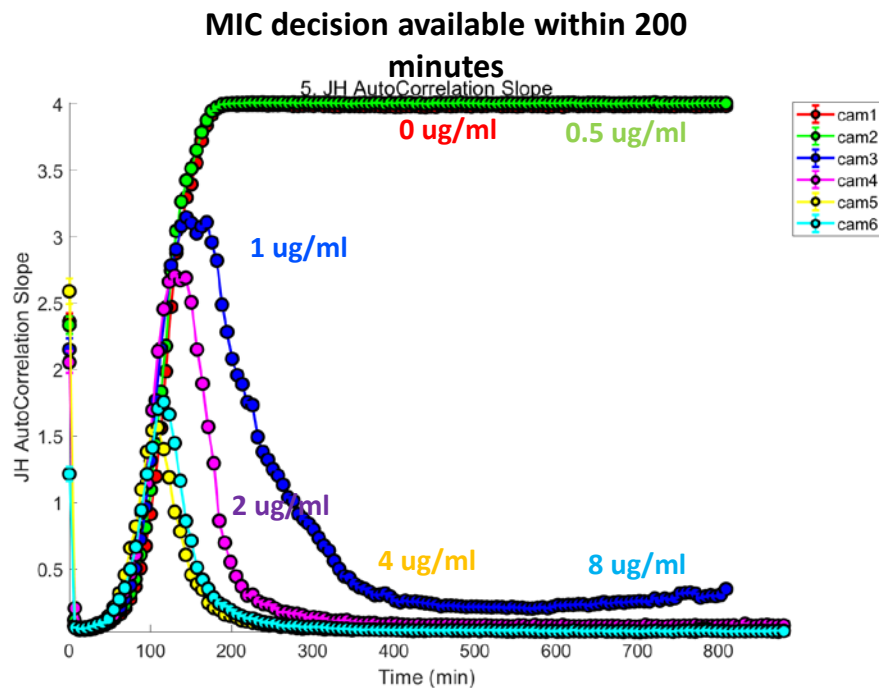
True label	Negative	125	739
	Positive	845	19
		Positive	Negative
		Predicted label	

Gram	Sensitivity
Positive	97.8%
Negative	85.8%
Total	91.6%

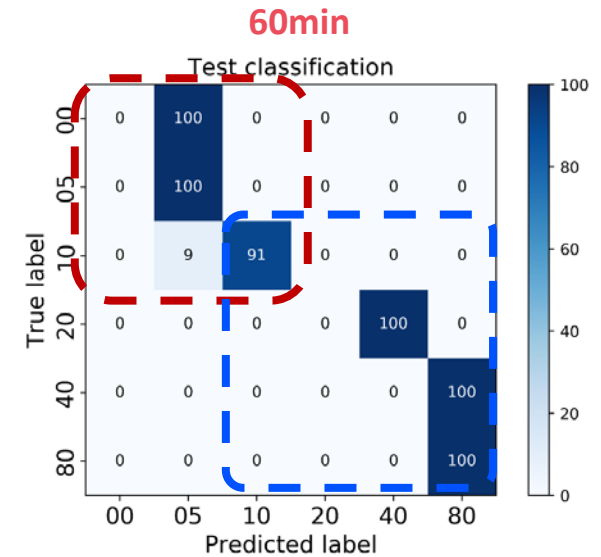
# Antibiotic Susceptibility Test Result

MIC decision was available within 200 minutes by amplifying existing signal

Decision on antibiotic susceptibility became available within 60 minutes through image analysis



Decision on resistance & susceptibility available within 60 minutes



## Product – Fast Agar Reader (Prototype Development in Progress)

Fast Agar Reader is a rapid bacteria detection device for labs/hospitals. Antibiotic Susceptibility Test (AST) can be conducted using this device. The process of conducting AST with Fast Agar Reader is very similar to the conventional disc diffusion method, but detection is faster thanks to our technology.



### Key Features

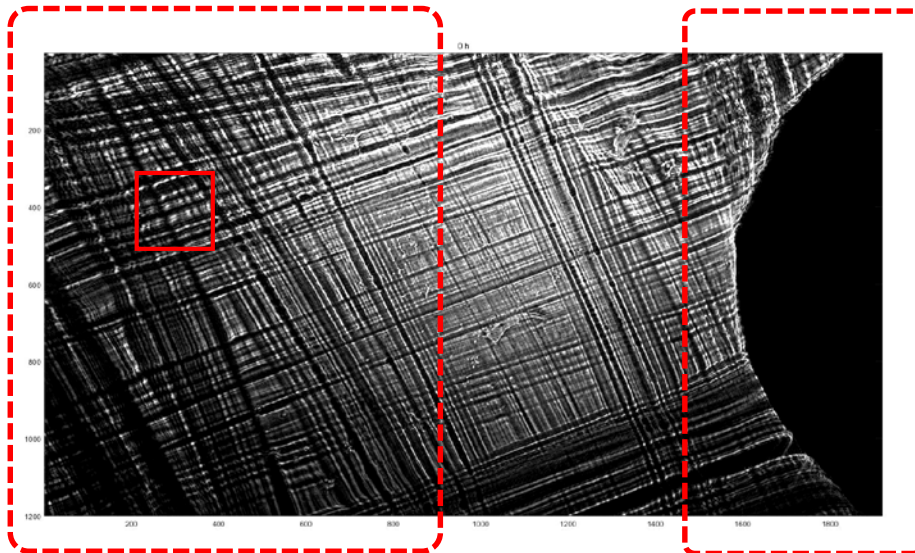
- Fast detection of bacteria
- Automated measurement

# AST Test Result

## RESULTS

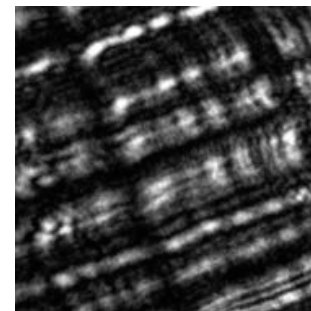
- Incubation system in THE.WAVE.TALK work same as conventional incubator.
- Effect of antibiotics has been monitored **within 4~5 hours**

[Raw image]

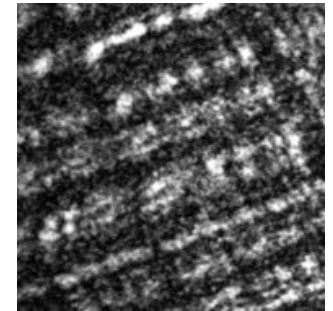


Bacterial colony  
growth area

Antimicrobial disk,  
shrinkage by absorption.



0 h



4 h

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[unseok-cho@thewavetalk.com](mailto:unseok-cho@thewavetalk.com)



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