Help stop the superbug!

A new gene which turns bacteria into powerful drug-resistant strains has landed in Singapore. Here is how you can protect yourself. FOON CHIAN HUI reports.

A new superbug, as yet unnamed, landed in Singapore at the start of this year, having hit headlines around the world. But its visit was not discovered until May, when the Ministry of Health (MOH) tested faecal samples of patients after it gave a name - New Delhi metallo-beta-lactamase-1 (NDM-1).

As reported in The Straits Times yesterday, the NDM-1 gene spread into Singapore with two people flying in from India and Bangladesh.

This new strain, like the existing multiresistant Staphylococcus aureus (MRSA), has the ability to turn bacteria into superbugs that are resistant to antibiotics.

While this episode underlined the urgent hospital infection control measures here, the public should not lose their guard down.

Superbugs may not always be confined to sick people in hospitals, said Associate Professor Raymond Lim, the head of the National University Hospital’s (NUH) microbiology department.

“Antibiotic-resistant bacteria tend to affect people who are seriously ill or are taking antibiotics for a prolonged period. But with the increase of antibiotic-resistant bacteria, it can also affect healthy people, both in the hospital and in the community,” he said.

Hence, the public should always be alert - starting from not being too lazy to wash their hands properly, either at home or in hospitals.

For instance, one should clean his hands with alcohol-based gel rubs before touching a patient, said Dr Ling Mui Lin, the director of infection control at Singapore General Hospital (SGH).

“For this purpose, alcohol rubs are placed at the feet of every bed, along corridors, at lift landings and near toilets so that they are freely accessible to both staff and visitors,” she said.

Meanwhile, avoid asking for antibiotics from doctors unnecessarily, added Prof Lim. This is because excessive and improper antibiotic use can accelerate the spread of drug-resistant superbugs.

Also, don’t assume antibiotics are the answer for every infection. Always report any signs of an infection,” he added.

As for the two NDM-1 cases here, both patients were isolated from other inpatients at SGH and were later discharged without incident.

Hence, hospitals also play a vital role in stemming the spread of superbugs.

Tan Tock Seng Hospital, for one, took to the streets last year to raise public awareness about proper hand hygiene.

Public-health understandings of the seven-step handwashing technique were held in popular shopping malls like United Square from last April to August. Hospitals here have also rolled out antibiotic stewardship programmes which monitor the prescription and proper use of antibiotics in order to slow the spread of drug-resistant bugs.

Assistant Professor Dato’ Dr Fisher of NUH, explaining how such a programme works, said that hospital pharmacists would visit the wards to check if the prescribed antibiotics were used appropriately.

“Fisher is in, then we will consult the infectious diseases specialist - for example, if a patient is given a broad-spectrum antibiotic, the doctor must have another antibiotic that targets a narrower spectrum of bacteria,” said the professor who heads NUH’s infectious diseases division.

As usual, the best way to fight the superbug is to control its spread via proper infection control measures.

Meanwhile, Singaporean authorities have been warning against the risk of infection. The Ministry of Health (MOH) advised that the public should avoid close contact with sick people, wash their hands frequently, and not to share towels or cups.

The Straits Times also reminded Singaporeans not to make up their own antibiotics, as the x-ray of the medicine chest can do more harm than good.

For now, the superbug is, indeed, a threat.

The Phillips family has been in the news recently, with three of the patients - an 8-year-old girl, her 66-year-old grandmother, and a 74-year-old man - testing positive for the superbug.

Meanwhile, the hospital in Malaysia has also detected a case of the superbug, with a patient who had recently travelled to Singapore.

Mr Khaw also thinks the numbers will go up. “The ease of transfer of the NDM-1 gene between bacterial populations also makes it harder to contain its spread,” he said.

“Despite our best efforts, the NDM-1 gene may eventually become established in our bacterial populations as it is already found in different species and strains of bacteria here. We can therefore expect more cases,” he added.

By SALMA KHAIL

ANOTHER four people in Singapore have been infected by the new drug-resistant New Delhi metallo-beta-lactamase-1 (NDM-1), the total to six.

Of the latest cases, three were patients aged between 34 and 44, as well as a 74-year-old man. As two of them had travelled abroad, it is believed they had brought the bug here.

The youngest patient may have acquired the superbug while he was working in a Livermore research tract.
A new strategy to detect antibiotics in milk

--- Based on sensors with controllable bio-enhanced blocks
MEASUREMENT SYSTEM

- BIOLOGICAL DETECTION
- CONTROLLABLE AMPLIFIER
- MICROFLUIDIC CHIP
- MICRO-DEVICE
- ENGINEERING DETECTION

SENSOR
MEASUREMENT SYSTEM

BIOLOGICAL DETECTION

SENSOR

CONTROLLABLE AMPLIFIER

ENGINEERING DETECTION

MICROFLUIDIC CHIP

MICRO-DEVICE
<table>
<thead>
<tr>
<th>kinds of antibiotics</th>
<th>importance of detection</th>
<th>degree of completion</th>
<th>new or old sensors</th>
<th>whether commit</th>
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<tbody>
<tr>
<td>Tetracycline</td>
<td>★★★★★</td>
<td>completed</td>
<td>old</td>
<td>✔️</td>
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<tr>
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<tr>
<td>Kanamycin</td>
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</tbody>
</table>
Antibiotic-free milk

Milk containing antibiotics
Tetracycline Biosensor

β-lactam Biosensor

MECHANISM
CONSTRUCTION
RESULT

The fluorescence intensity of EGFP induced by tetracycline

Tetracycline Biosensor
RESULT

The fluorescence intensity of EGFP induced by tetracycline

\[ y = 5.4569x + 0.1673 \]

\[ R^2 = 0.9944 \]
RESULT

The fluorescence intensity of EGFP induced by β-lactam

β-lactam Biosensor

Concentration of Beta-lactam (ng/mL)

Fluorescence intensity

2h

2.5h

3h
RESULT

The fluorescence intensity of EGFP induced by $\beta$-lactam

\[
y = 0.0198x + 0.3169 \\
R^2 = 0.9621
\]
CONTROLLABLE AMPLIFIER
RESULT
The fluorescence intensity of EGFP

Data

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<thead>
<tr>
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<th>Fluorescence Intensity</th>
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<tr>
<td>15</td>
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</tr>
<tr>
<td>25</td>
<td>7.4</td>
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<tr>
<td>30</td>
<td>7.6</td>
</tr>
<tr>
<td>35</td>
<td>7.8</td>
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<td>50</td>
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</table>

- **Only egfp transduction**
- **Amplifier plasmid transduction**
The fluorescence intensity of EGFP

<table>
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<tr>
<th>concentration: ng/ml</th>
<th>fluorescence intensity</th>
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<tbody>
<tr>
<td>15</td>
<td>Controller plasmid transduction (IPTG=0)</td>
</tr>
<tr>
<td>25</td>
<td>Controller plasmid transduction (IPTG=0.33ug/L)</td>
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<tr>
<td>35</td>
<td>Controller plasmid transduction (IPTG=0)</td>
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<tr>
<td>50</td>
<td>Controller plasmid transduction (IPTG=0.33ug/L)</td>
</tr>
<tr>
<td>100</td>
<td>Controller plasmid transduction (IPTG=0)</td>
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</tbody>
</table>

Controller plasmid transduction
IPTG=0

Controller plasmid transduction
IPTG=0.33ug/L
MEASUREMENT SYSTEM

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- MICROFLUIDIC CHIP
- ENGINEERING DETECTION
- MICRO-DEVICE
MEASUREMENT
MEASUREMENT
Our aim is to convert the biological achievements into practical productive forces.

------BIT iGEM team
DETECTION SYSTEM
MICROFLUIDIC CHIP
PARAMETER

- Cheap (About $30 )
- Convenient (Only 3 steps)
- Sensitive (Standard Fluorescein sodium 5ng/mol)
- Portable (10cmX6.5cmX5cm) can achieve on-spot detection
- Universal (can detect any kinds of antibiotics )
- Integrated (All parts are sealed, user-friendly)
DETECTION SYSTEM

Can it work?

Micro System?

Let me show you our data

Notice: Pictures from Runaway comics
Fluorescein sodium - Fluorescence intensity curve

Relative fluorescence intensity vs. Fluorescein sodium concentration (ng/ml)

$R^2 = 0.9842$
Fluorescein sodium-Fluorescence intensity curve

Relative fluorescence intensity vs. Fluorescein sodium concentration (ng/ml)

R² = 0.994
DETECTION SYSTEM

Can you detect real milk?

Fluorescein sodium?

OK, Let me show you real sample test

Notice: Pictures from Runaway comics
Sample 0. Zero (Blank)
Sample 1. Positive (20ng/ml Tet)
Sample 2. Negative
Sample 3. Negative
Sample 4. Negative
Sample 5. Positive (100ng/ml Tet)
Sample 6. Negative
Sample 7. Negative

HPLC method:

Our method:
DETECTION SYSTEM

Pretreatment

Processing (15min)

Column preparation (1h)

Data analysis
DETECTION SYSTEM

Add Milk → wait → Look at the screen

Relative Floessence = 40 Safe
DETECTION SYSTEM

![Graph showing dangerous levels for positive and negative samples](image)

**Positive**

Sample Number: 1, 2, 3, 4, 5, 6, 7, 8

- Data from our system
- Data from Laboratory instruments

**Negative**
APPLICATION

Standard Fluorescent Detection Kit for iGEM

Parts of the pictures from: http://image.baidu.com
HUMAN PRACTICE
HUMAN PRACTICE
HUMAN PRACTICE
ACKNOWLEDGE

Instructors

Prof. Yulin Deng    Prof. Hong Qing    Prof. Hong Ma
ACKNOWLEDGE

Advisors

Liu Kefu    Man yan    Qin kuiwei    Lei runhong
ACKNOWLEDGE
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MICRO-DEVICE

THANKS FOR YOUR ATTENTION
Q&A

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