

# Study the possibility of using honey as source of substances with antimicrobial properties

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# Do you remember?

## A significant role of honey bees in production of food

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30 October, 2017

WULS

# No bees, no food, must know! (1)



**WITH BEES**



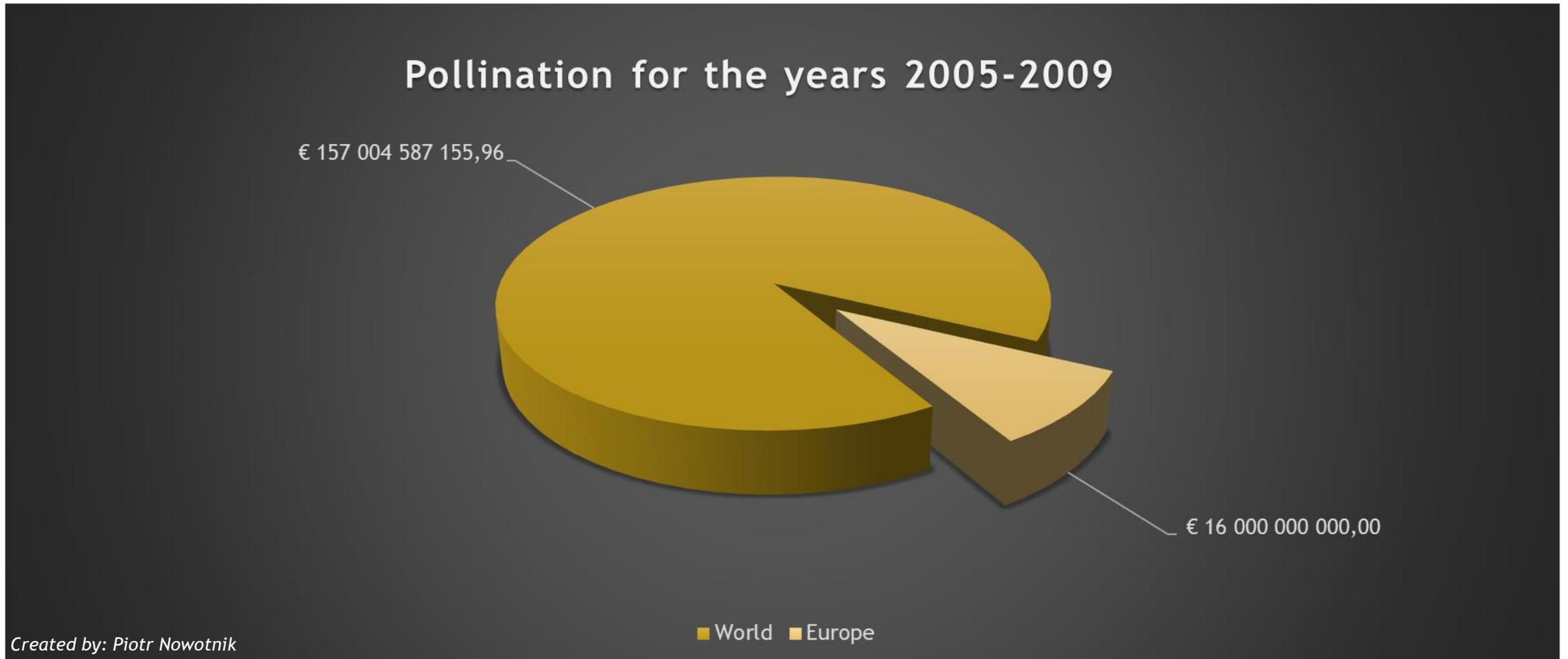
**WITHOUT BEES**

# No bees, no food, must know! (2)

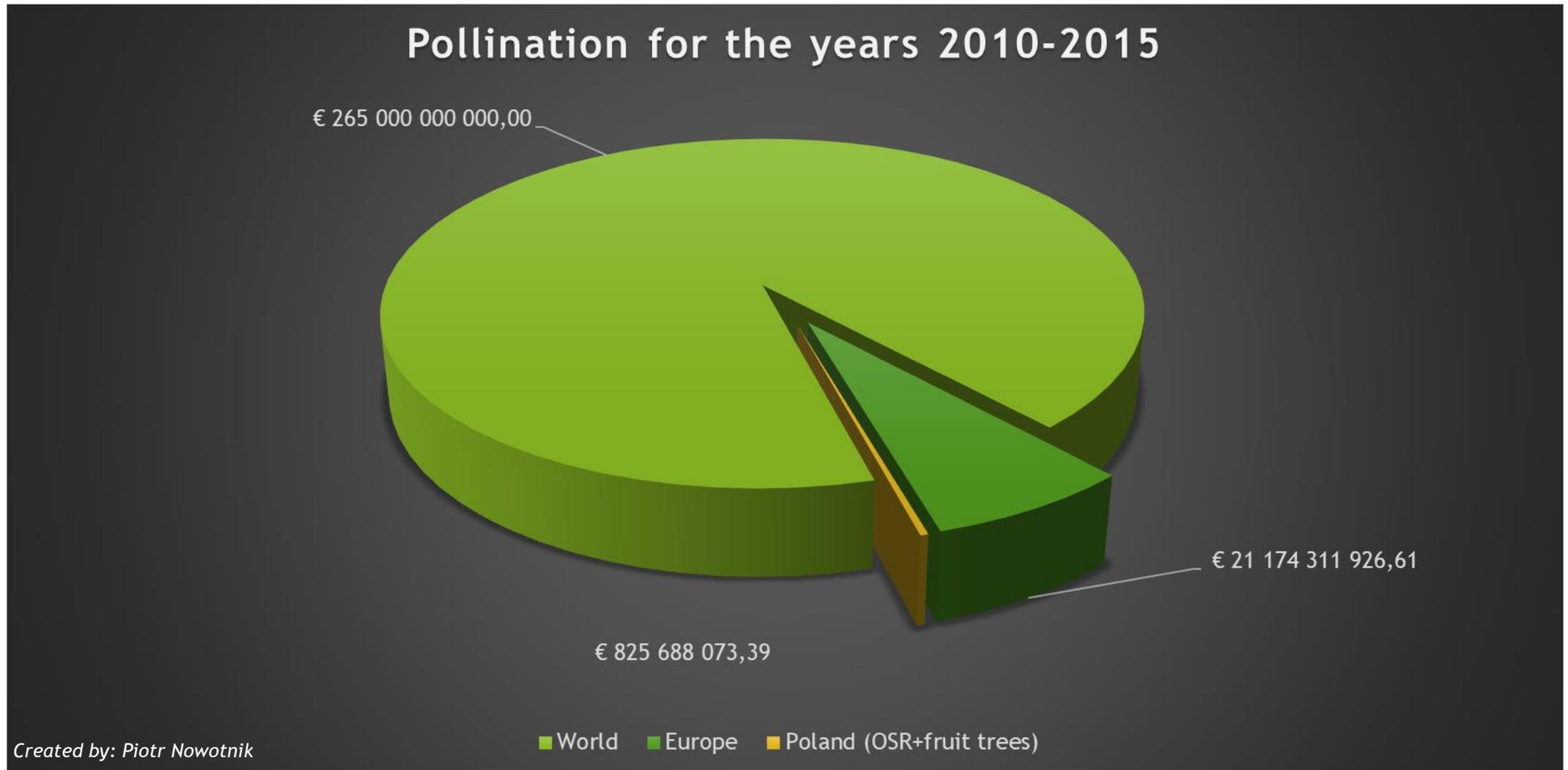


Global production food with bees and without bees

# No bees, no food, must know! (3)



# No bees, no food, must know! (4)



# Thank you bees!

If a last bee will die, then...

- ▶ Extinct 75 % plants;
- ▶ Decreasing a production of food in 1/3 in the world;
- ▶ Inheritance of agriculture production;
- ▶ Producing animal feeds will be not possible;
- ▶ Won't buy apples, onions, carrot, lemons, broccoli, peppers, coffee, tea, avocado, cucumbers;
- ▶ Food will be more expensive;
- ▶ Economy will lose 300 000 000 000 Euro;
- ▶ A quality of food will be worse;

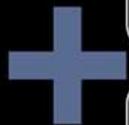
Today...

## NATIONAL SUMMARY DATA

Estimated minimum number of illnesses and deaths caused by antibiotic resistance\*:

At least  **2,049,442** illnesses,  
 **23,000** deaths

*\*bacteria and fungus included in this report*



Estimated minimum number of illnesses and death due to *Clostridium difficile* (*C. difficile*), a unique bacterial infection that, although not significantly resistant to the drugs used to treat it, is directly related to antibiotic use and resistance:

At least  **250,000** illnesses,  
 **14,000** deaths

### WHERE DO INFECTIONS HAPPEN?

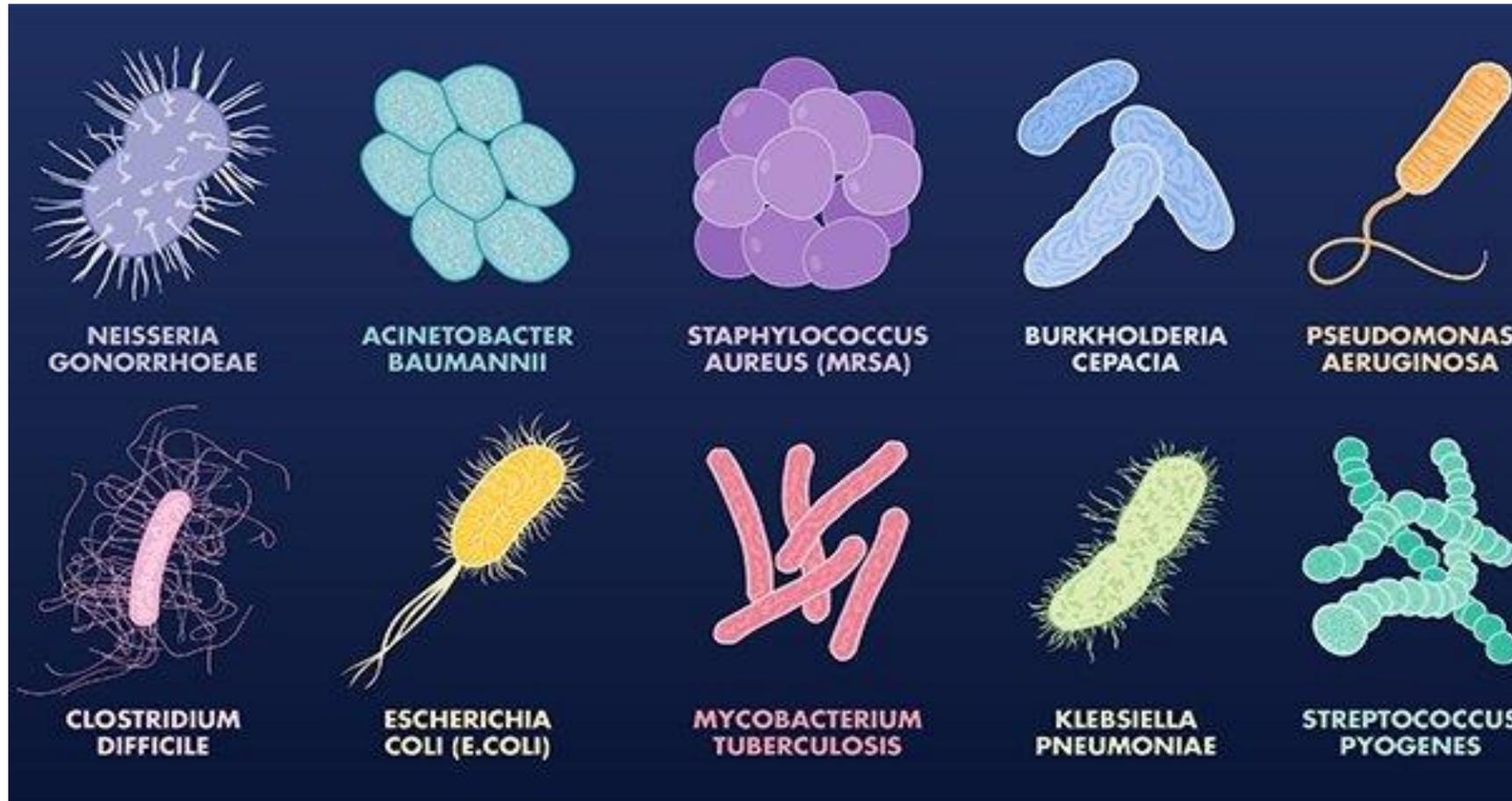
Antibiotic-resistant infections can happen anywhere. Data show that most happen in the general community; however, most deaths related to antibiotic resistance happen in healthcare settings, such as hospitals and nursing homes.

CS239599



U.S. Department of  
Health and Human Services  
Centers for Disease  
Control and Prevention

It's ready to attack and kill you!



# Global trouble

**GLOBAL**

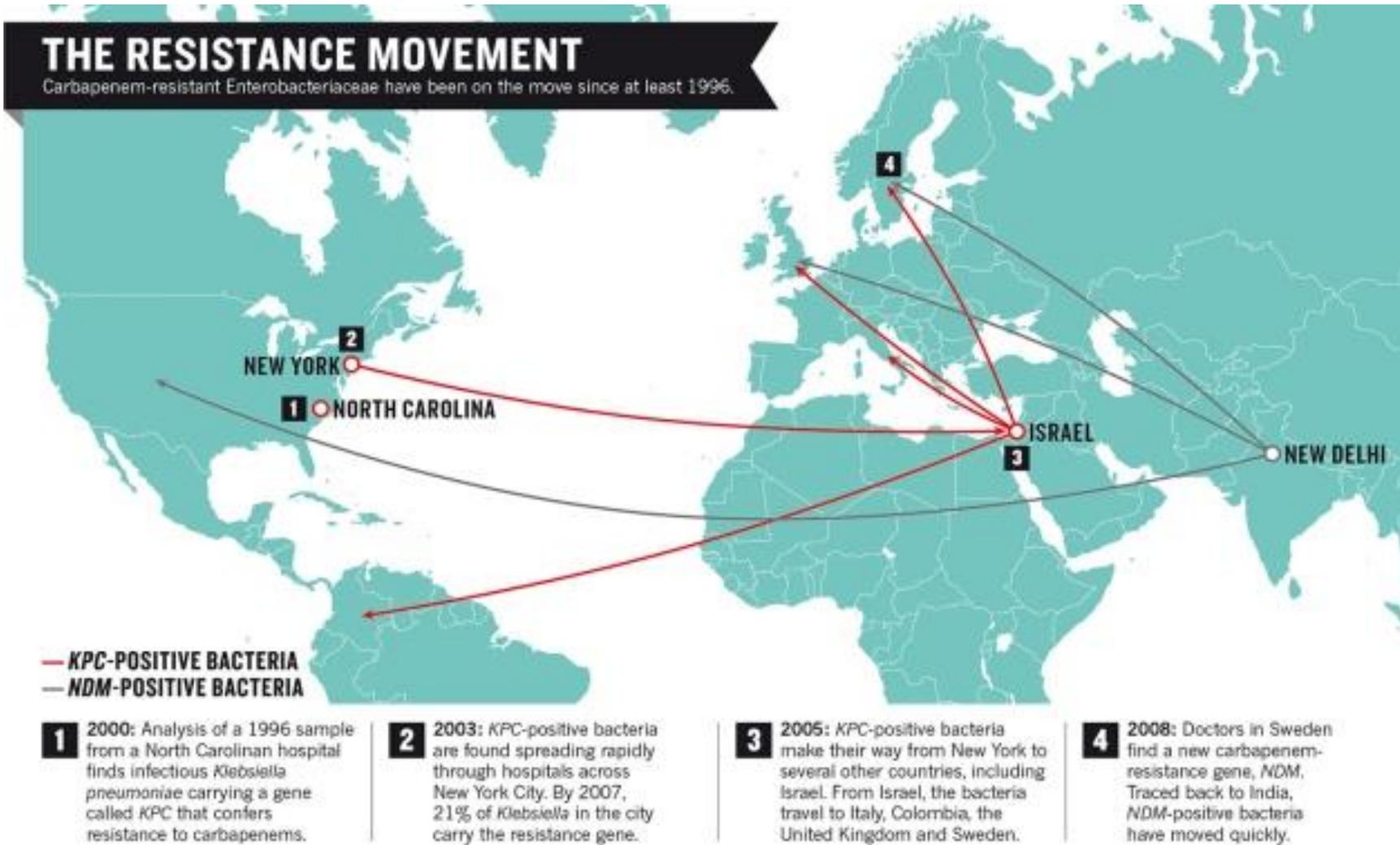
A failure to address the problem of antibiotic resistance could result in:



**10m**  
**deaths**  
**by 2050**

**Costing**  
 **£66**  
**trillion**

# The resistance is rising up



# How should we react?

## Rapid diagnostics would reduce unnecessary prescription

Out of 40 million people who are given antibiotics for respiratory issues, annually in the US:

**27 million**  
get antibiotics unnecessarily

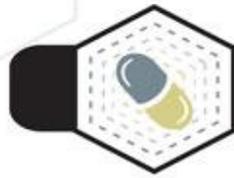
**13 million**  
who need antibiotics get them



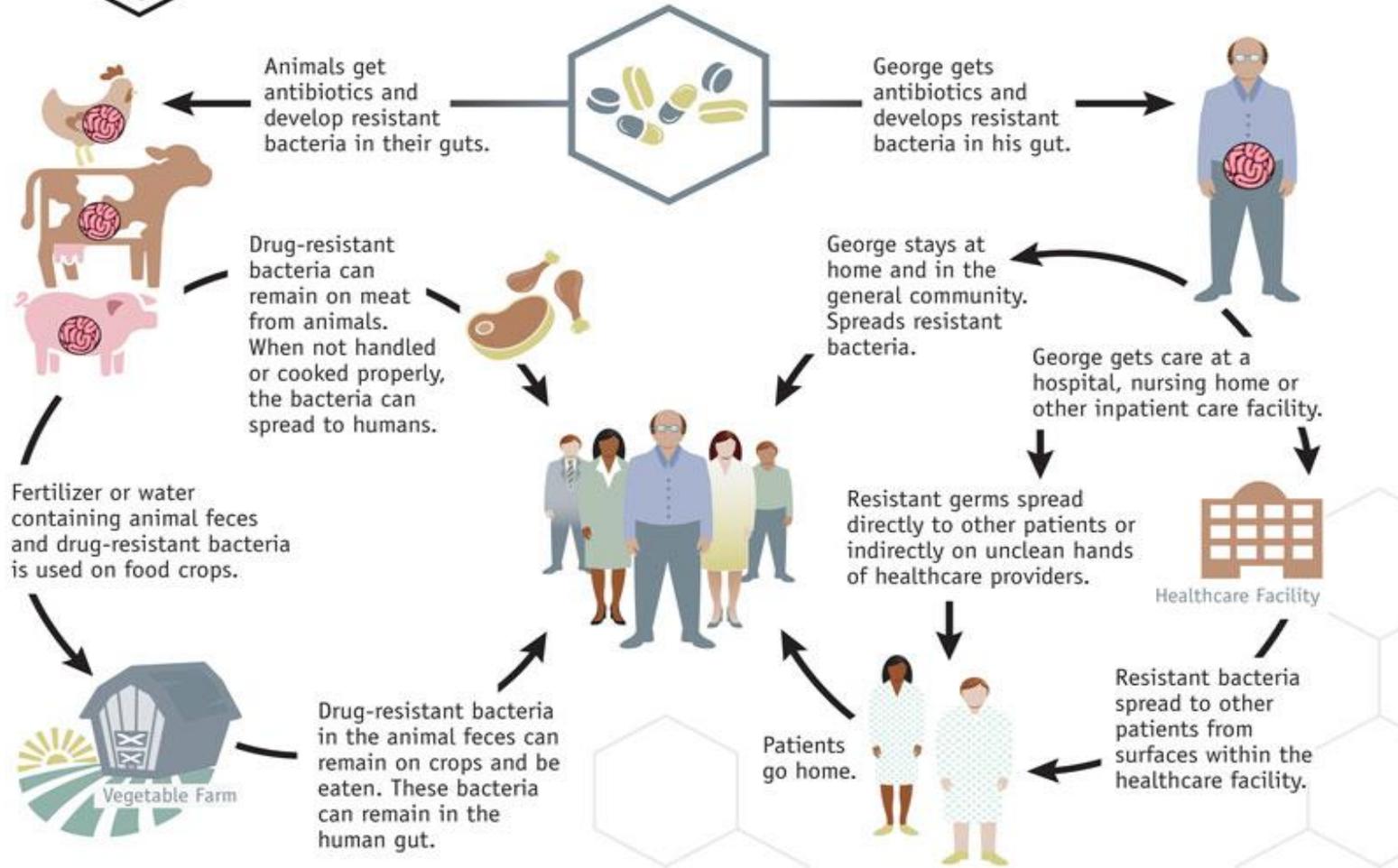
NORWEGIAN **CANCER** SOCIETY

Source: Wellcome trust, HM Government

# Sources of growing resistance



## Examples of How Antibiotic Resistance Spreads



Simply using antibiotics creates resistance. These drugs should only be used to treat infections.

# ANTIBIOTIC RESISTANCE

## from the farm to the table

**RESISTANCE** All animals carry **bacteria** in their intestines

Antibiotics are given to animals

Antibiotics kill most bacteria

But resistant bacteria survive and multiply

**SPREAD** Resistant bacteria can spread to...

animal products

produce through contaminated water or soil

prepared food through contaminated surfaces

the environment when animals poop

**EXPOSURE** People can get sick with resistant infections from...

contaminated food

contaminated environment

**IMPACT** Some resistant infections cause...

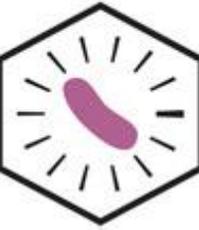
mild illness

severe illness and may lead to death

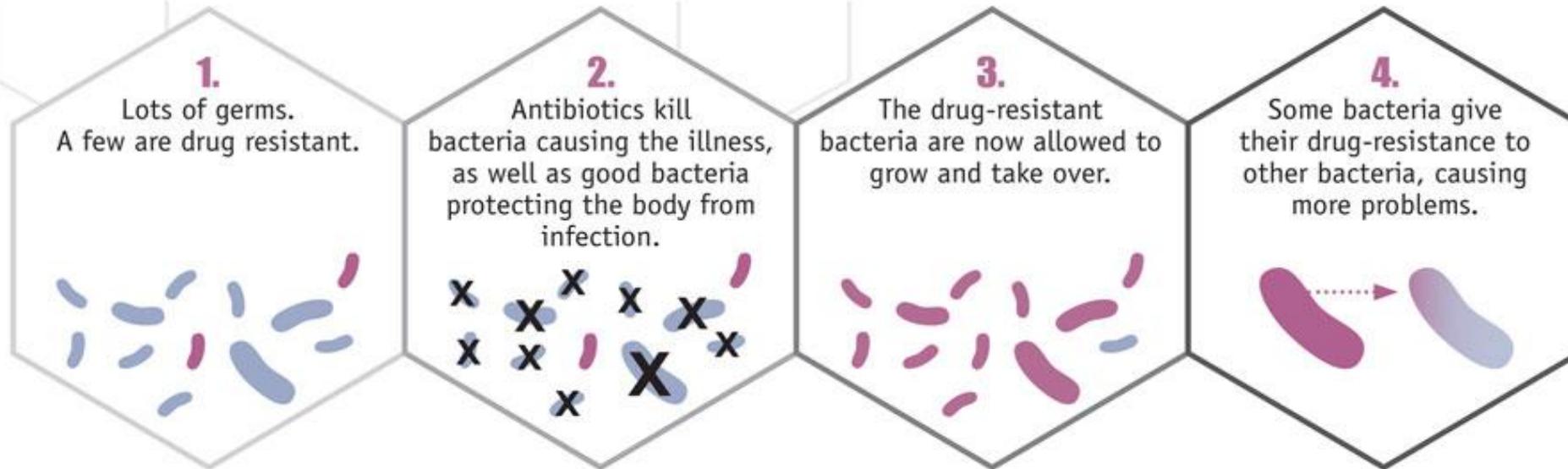
Learn more about antibiotic resistance and food safety at [www.cdc.gov/food/safety/antibiotic-resistance.html](http://www.cdc.gov/food/safety/antibiotic-resistance.html)

The chain of spreading  
antibiotics in ecosystem

# Creating of resistance behaviour



## How Antibiotic Resistance Happens



**EUROPE**



**25,000**

**people die each year**

as a result of hospital infections caused by

**5 key  
resistant  
bacteria**



**Chosen and dangerous!!!**

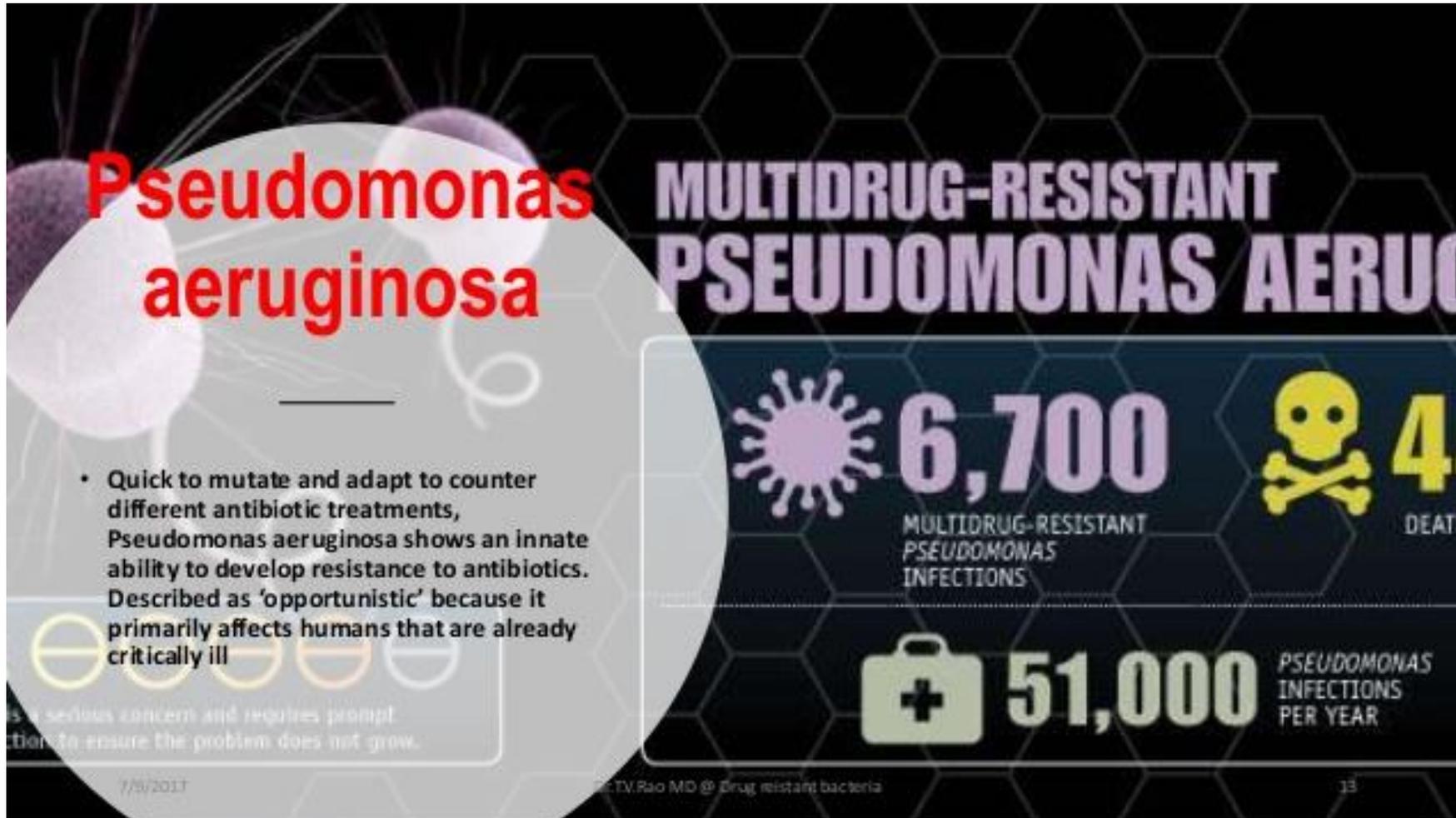
# MRSA - the most dangerous pathogens

## Staphylococcus aureus (MRSA)

- More commonly known as MRSA (which stands for Methicillin-resistant Staphylococcus aureus), this 'superbug' is very easily spread through human contact and can cause a range of illnesses from skin disorders to deadly diseases like meningitis and pneumonia. Most often treated with Penicillin type antibiotics, by 1960, 80 per cent of hospital samples were antibiotic resistant.



# *Pseudomonas aeruginosa*



The infographic features a dark background with a hexagonal grid pattern. On the left, a large, semi-transparent circle contains a microscopic image of a bacterium with flagella. The text 'Pseudomonas aeruginosa' is written in red over this image. To the right, the title 'MULTIDRUG-RESISTANT PSEUDOMONAS AERUGINOSA' is displayed in large, bold, white letters. Below the title, there are three main data points: 1) A purple spiky icon next to the number '6,700' and the text 'MULTIDRUG-RESISTANT PSEUDOMONAS INFECTIONS'. 2) A yellow skull and crossbones icon next to the number '44' and the text 'DEATHS'. 3) A green first aid kit icon next to the number '51,000' and the text 'PSEUDOMONAS INFECTIONS PER YEAR'. At the bottom left, there is a small text box with a white border containing a list of bullet points and a date '7/3/2017'. At the bottom center, there is a small text box with a white border containing the name 'Dr. TV Rao MD @ Drug resistant bacteria'. At the bottom right, there is a small number '13'.

## Pseudomonas aeruginosa

- Quick to mutate and adapt to counter different antibiotic treatments, *Pseudomonas aeruginosa* shows an innate ability to develop resistance to antibiotics. Described as 'opportunistic' because it primarily affects humans that are already critically ill

7/3/2017

Dr. TV Rao MD @ Drug resistant bacteria

13

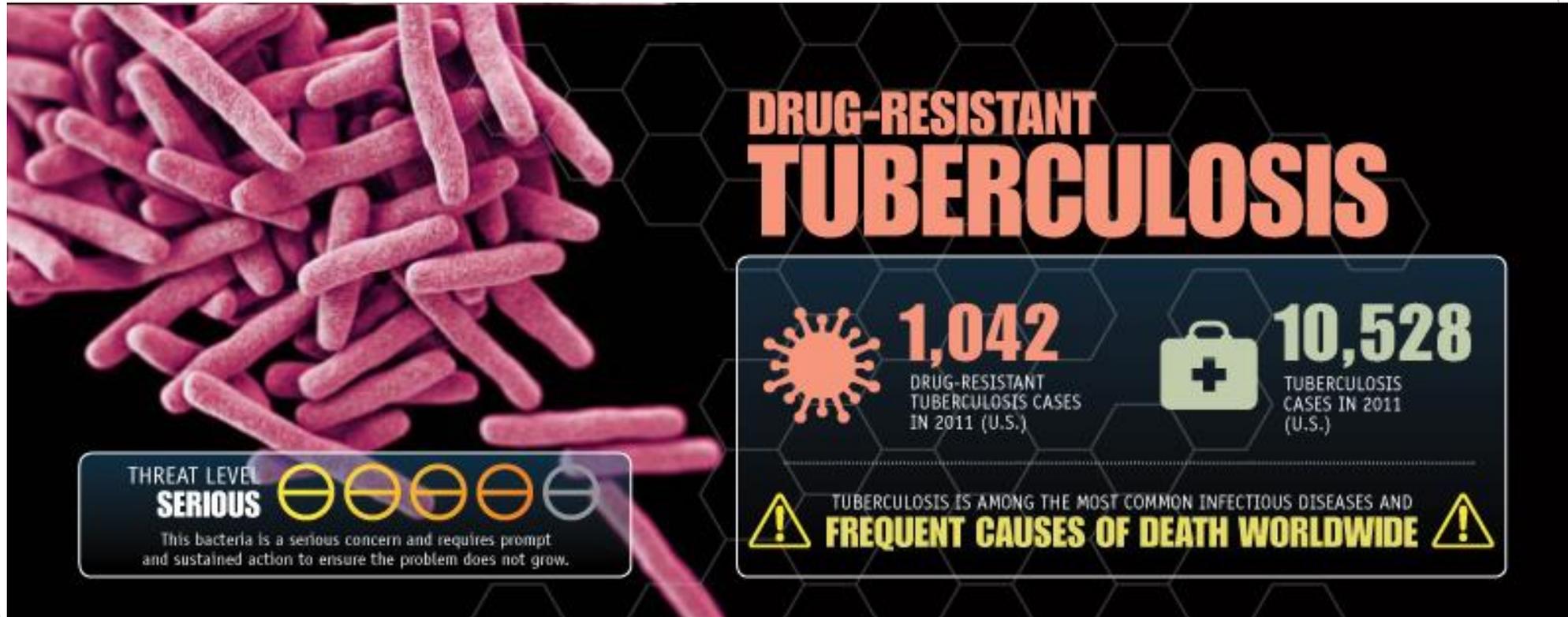
### MULTIDRUG-RESISTANT PSEUDOMONAS AERUGINOSA

6,700 MULTIDRUG-RESISTANT PSEUDOMONAS INFECTIONS

44 DEATHS

51,000 PSEUDOMONAS INFECTIONS PER YEAR

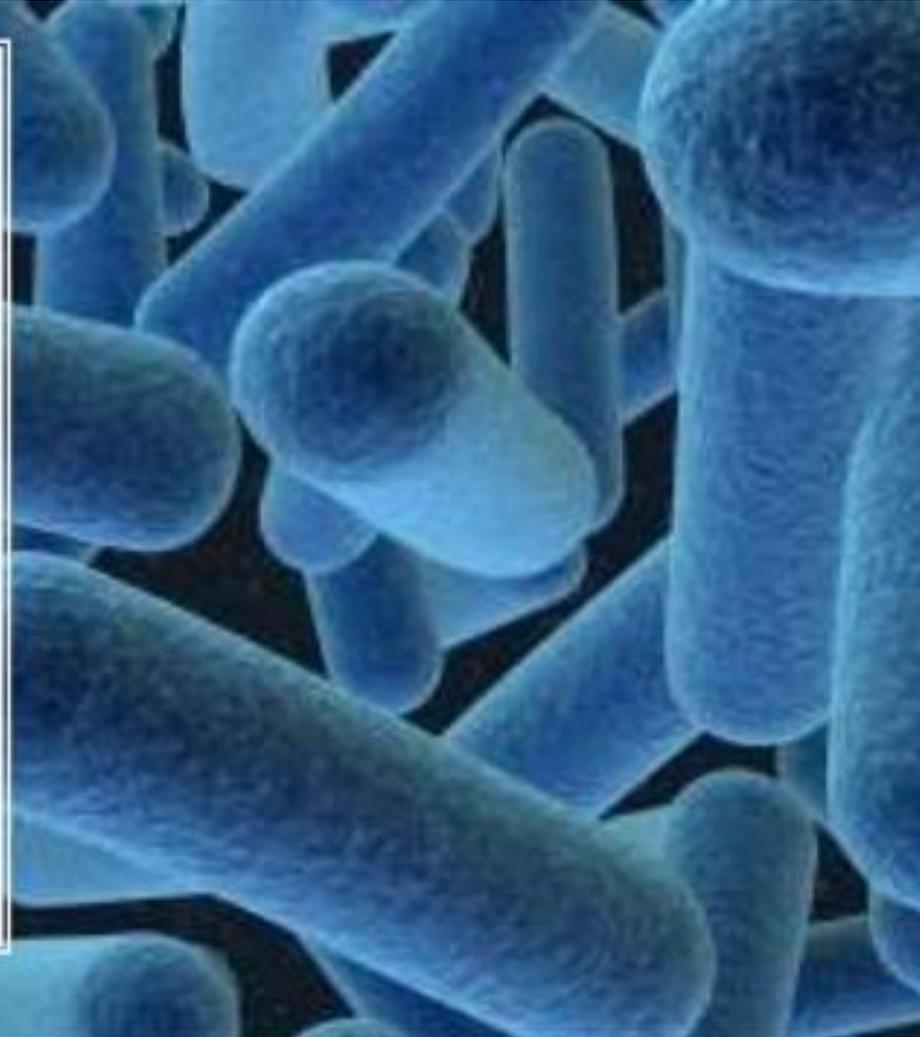
# *Mycobacterium tuberculosis*



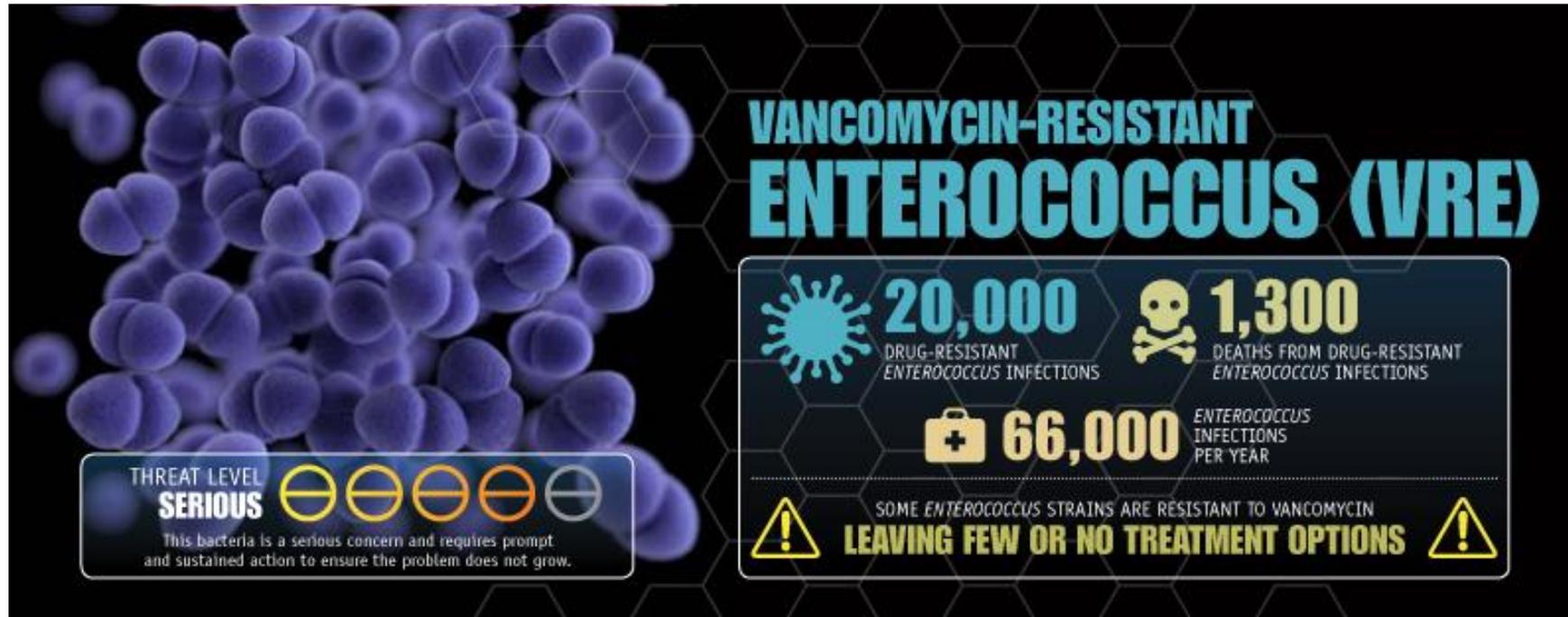
# *Clostridium difficile*

## 5. CLOSTRIDIUM DIFFICILE

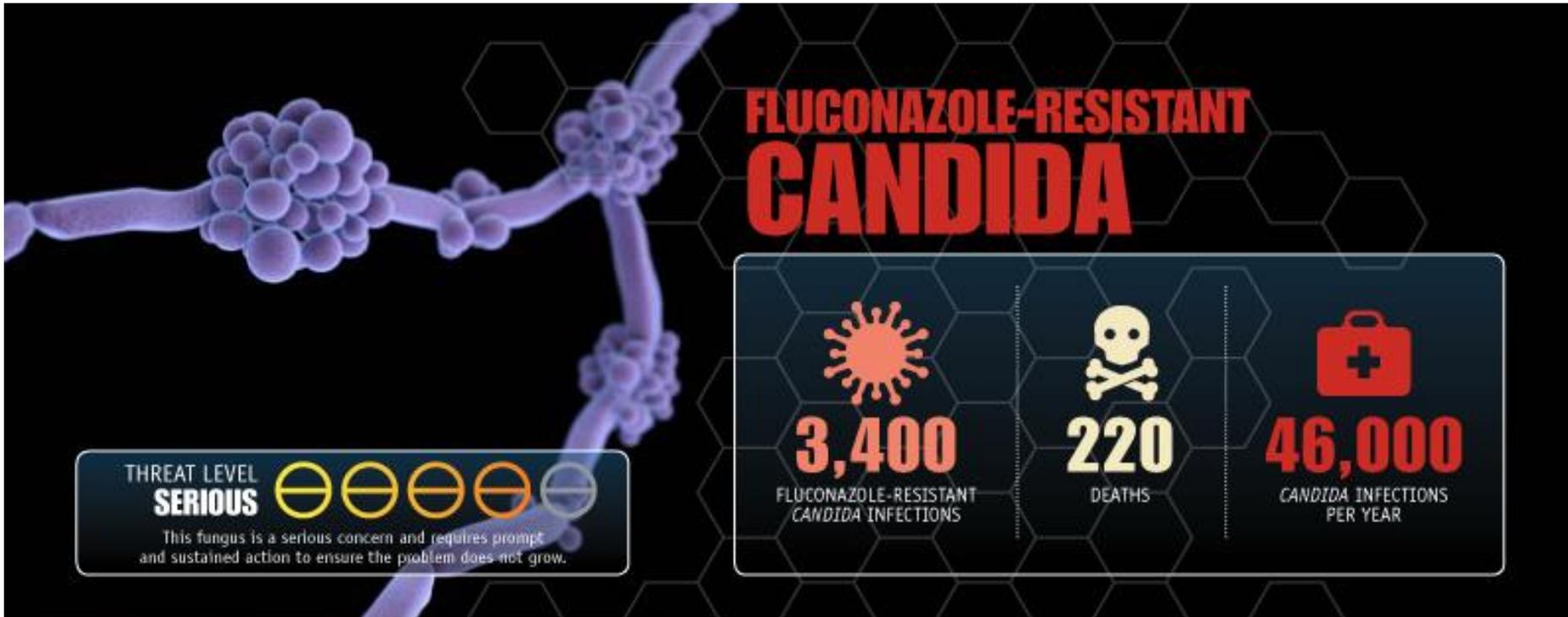
- **First Documented:** 1935
- **Illness Caused:** Diarrhoea
- **Antibiotic Resistance:** Low
- **Virulence:** Dangerous
- Consistent presence in hospitals around the world.
- Primarily an easily spread type of diarrhoea that can lead to complications in the colon.
- Several significant outbreaks of *C. difficile* have made the news in the UK.
- Despite major efforts in improving hygiene in hospitals, the bacteria is responsible for a significant number of deaths globally.



# *Enterococcus spp.*



# *Candida spp.*



# Shigella spp.



# *Streptococcus pneumoniae*



# Disc-diffusion method - know how



# Tips for the prevention of antibiotic resistance

## What should we do?

Embrace a healthy lifestyle through eating a balanced nutritious diet, getting enough exercise, and practicing good hygiene. This could help you to avoid the need for antibiotics.

Clean your hands regularly and thoroughly with soap in your home, office, school, gym and other places to prevent the spread of infections.

Keep your vaccinations up to date.

If it is medically necessary to take antibiotics, then take them exactly as prescribed by the doctor or pharmacist. Do not skip any doses, and do not stop taking them until the course is complete.

Do not 'save' antibiotics prescribed for one illness, to take them when you fall ill at a later date. The same antibiotic might not be appropriate for the treatment of illnesses with similar symptoms.

If you do fall ill, do not demand antibiotics from your doctor. Antibiotics generally do not work for viral infections, such as flu or the common cold.

Talk to your family and friends about the importance of only taking antibiotics when necessary and appropriate.

Do not share your prescribed antibiotics with others – this can lead to misuse and fuel the development of antibiotic resistance.



You're in safe hands

# Honey as alternative for treatment? Why not?!

- ▶ Honey, pollen, bee bread, wax, propolis, venom and royal jelly are products produced in complex and complicated way by honey bees;
- ▶ Honey and propolis have the strongest impact on microorganisms;
- ▶ Dark species of honey such as buckwheat, heather or honeydew contain larger antibiotic activity than bright honey f.e.: multiflower, clover, acacia, OSR-rape;
- ▶ New Zealand honey, Manuka or Nigerian honey and honey from *Apis dorsata* bees demonstrated high activity but not the highest;
- ▶ Polish honey is as effective as Manuka, I also claim that our honey is better;
- ▶ Honey and other bee products have unique components with antimicrobial properties, it's a lot of chemical substances so bacteria can't acquire resistance;



# Components of honey from flowers and pollen

A contain of water : 11,7-15,6% for nectar honey and 15,9-18,5% for honeydew

A contain of glucose and fructose : 70-80%

A contain of sucrose : < 5 %

pH : 3,5-5,12

A contain of acids : to 0,5 %

A contain of proteins : 0,05-1,6 %

Amount of aminoacids : 18

A contain of proline (immune protein) : 17,5 mg% - 89,2 mg%

Minerals (f.i.: K, Ca, Mg, Na) and vitamins : 0,05-0,35 %

A contain of flavonoids : 0,14-29,94 mg/kg

A contain of phenolacids : 0,45-47,87 mg/kg

In addition there are: oils, therpens, esters, aldehydes, ketones, alcohols, enzymes.



# Antimicrobial properties in honey

1. High osmotic pressure (high contain of saccharids)
2. Low contain of water level - water activity : 0,60 where bacteria need to live above 0,91-0,98
3. In these conditions, bacteria can't develop and grow. A process of plasmolysis begin to in progress
4. Low pH doesn't allow to develop microorganisms
5. Enzymes activate H<sub>2</sub>O<sub>2</sub> and lisosyme, which are known as antiseptic substances,  
f. e.: 1 g of honey contains 3 µg/g of hydrogen peroxide
6. Honey contains immune proteins such as: royalisyne, apidicine, abacin which have strong impact on microorganisms
7. Honey has a lot of flavonoids and phenolacids, which kill paramount of bacteria by many mechanisms of reducing microorganisms. It is confirmed, that antibiotic properties have:  
2-hydroxy-3-phenylpropionic acid, syringic acid, 2-hydroxybenzoic acid, p-hydroxybenzoic acid, p-coumaric acid, 10-HDA acid, kempferol, chrysin, carbolic esters of coffee acid, gallic acid, cinnamic acids complexes, ethereal oils and other

IT'S MULTI-COMPONENTS, NATURAL ANTIBIOTIC!



# Look at efficiency on paramount microorganisms

Bakterie wyizolowane z ran	Strefy zahamowania wzrostu wokół studzienek wypełnionych miodem (mm)
Ziarniaki Gram-dodatnie <i>Staphylococcus aureus</i> <i>Streptococcus pyogenes</i> <i>Enterococcus faecalis</i>	$\geq 30$ $\geq 30$ $\geq 30$
Pałeczki Gram-ujemne tlenowe <i>Escherichia coli</i> <i>Klebsiella pneumoniae</i> <i>Proteus mirabilis</i> <i>Proteus</i> (inne gatunki) <i>Pseudomonas aeruginosa</i>	$\geq 30$ $\geq 30$ $\geq 30$ 16-28 $\leq 14$
Bakterie tlenowe <i>Bacteroides fragilis</i> <i>Clostridium walchii</i> <i>Clostridium tetani</i> <i>Clostridium oedematiens</i>	$\geq 30$ $\geq 30$ $\geq 30$ $\leq 14$
Strefy zahamowania wzrostu szczepów: $\geq 30$ mm – szczepy wrażliwe; 16-28 mm – szczepy średnio wrażliwe; $\leq 14$ mm – szczepy odporne	

Gatunki badanych ziarniaków	Oporność na antybiotyki	Liczba szczepów	Średnie stężenia miodu hamujące wzrost bakterii (%)	
			manuka	łąkowy
<i>Staphylococcus aureus</i>	MRSA+	18	3,0	3,1
<i>Enterococcus faecium</i>	VRE+	15	4,7	8,3
<i>Enterococcus faecalis</i>	VRE-	7	4,9	9,7
<i>Enterococcus</i> sp <sup>1</sup>	VRE+	5	4,5	9,5

<sup>1</sup>*Enterococcus faecalis* (3), *E. avium* (1), *E. raffinosus* (1)  
 MRSA+ (szczepy odporne na metacyklinę)  
 VRE+ (szczepy odporne na wankomycynę)  
 VRE- (szczepy wrażliwe na wankomycynę)

minimum inhibitory concentration

Pozycja piśmiennictwa	Drobnoustroje i ich pochodzenie	Liczba szczepów	MIC (%)
Brady i Molan (16)	Bakterie enteropatogenne <sup>1</sup>	17	2,0-11,0
Cooper i Molan (17)	<i>Pseudomonas</i> sp. <sup>2</sup>	20	5,5-8,7
Cooper i wsp. (18)	<i>Staphylococcus aureus</i> <sup>3</sup>	58	2,0-3,0
Cooper i wsp. (19)	<i>Burkholderia cepacia</i> <sup>4</sup>	20	2,9-6,9
Allen i wsp. (20)	<i>Staphylococcus aureus</i> MRSA i VRE <sup>5</sup>	142	4,1-13,7
Cooper (21)	Bakterie izolowane z zakażonych ran <sup>6</sup>	18	3,2-9,0
Cooper i wsp. (22)	<i>Pseudomonas aeruginosa</i> <sup>7</sup>	17	5,5-12,3
Cooper i wsp. (23)	Bakterie izolowane z zakażonych ran <sup>6</sup>	45	4,1-6,9
French i wsp. (24)	Bakterie izolowane z materiału zakaźnego <sup>9</sup>	18	4,1-5,5
Mullai i Menon (25)	<i>Pseudomonas aeruginosa</i> <sup>10</sup>	152	20,0

Paleczki Gram-ujemne: *Escherichia coli*, *Salmonella* sp., *Shigella* sp., *Vibrio* sp., *Yersinia enterocolitica*, *Campylobacter jejuni*

Paleczki izolowane z zakażonych ran

Ziarniaki izolowane z zakażonych ran

Paleczki izolowane od chorych z mukowiscydozą

Ziarniaki odporne na metycylinę i wankomycynę

Ziarniaki Gram-dodatnie: *Staphylococcus aureus* MRSA (oporne na metycylinę), *Enterococcus faecalis*; pałeczki Gram-ujemne: *Escherichia coli*, *Klebsiella oxytoca*, *Proteus morgani*, *Proteus mirabilis*, *Serratia narocenscens*

Paleczki izolowane z zakażonych ran oparzeniowych

Ziarniaki Gram-dodatnie: *Staphylococcus aureus* MRSA (oporne na metycylinę), *Enterococcus faecalis*, *Enterococcus faecium* i 2 inne gatunki *Enterococcus* – wszystkie odporne na wankomycynę

Ziarniaki *Staphylococcus epidermidis* i 4 inne gatunki *Staphylococcus* izolowane z krwi, płynu mózgowego, wydzieliny oskrzelowej i zgłębników

<sup>9</sup>Paleczki izolowane z krwi oraz zakażonych ran

**Tabela 4. Działanie miodu manuka na drobnoustroje chorobotwórcze dla człowieka (metodyka D).**

Pozycja piśmiennictwa	Drobnoustroje i ich pochodzenie	Liczba szczepów	MIC (%)
Wilkinson i Cavanagh (26)	Bakterie wywołujące zakażenia ran <sup>1</sup>	2	19,3; 12,3
Irish i wsp. (27)	<i>Candida</i> sp. <sup>2</sup>	38	33,4-42,6

# Discovery at Lund University

- ▶ Thirteen lactic acid bacteria found in the honey stomach of bees have shown promising results in a series of studies. The group of bacteria counteracted antibiotic-resistant MRSA in lab experiments. The bacteria, mixed into honey, has healed horses with persistent wounds. The formula has previously been shown to protect against bee colony collapse
- ▶ Researchers at Lund University in Sweden have identified a unique group of 13 lactic acid bacteria found in fresh honey, from the honey stomach of bees. The bacteria produce a myriad of active antimicrobial compounds.

# Discovery at Lund University

- ▶ These lactic acid bacteria have now been tested on severe human wound pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA), *Pseudomonas aeruginosa* and vancomycin-resistant *Enterococcus* (VRE), among others. When the lactic acid bacteria were applied to the pathogens in the laboratory, it counteracted all of them.
- ▶ While the effect on human bacteria has only been tested in a lab environment thus far, the lactic acid bacteria has been applied directly to horses with persistent wounds. The LAB was mixed with honey and applied to ten horses; where the owners had tried several other methods to no avail. All of the horses' wounds were healed by the mixture.
- ▶ Antibiotics are mostly one active substance, effective against only a narrow spectrum of bacteria. When used alive, these 13 lactic acid bacteria produce the right kind of antimicrobial compounds as needed, depending on the threat.

Thank you for your attention!

Peter

