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

Piotr Robert Nowotnik

30 October, 2017

WULS

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

WITH BEES

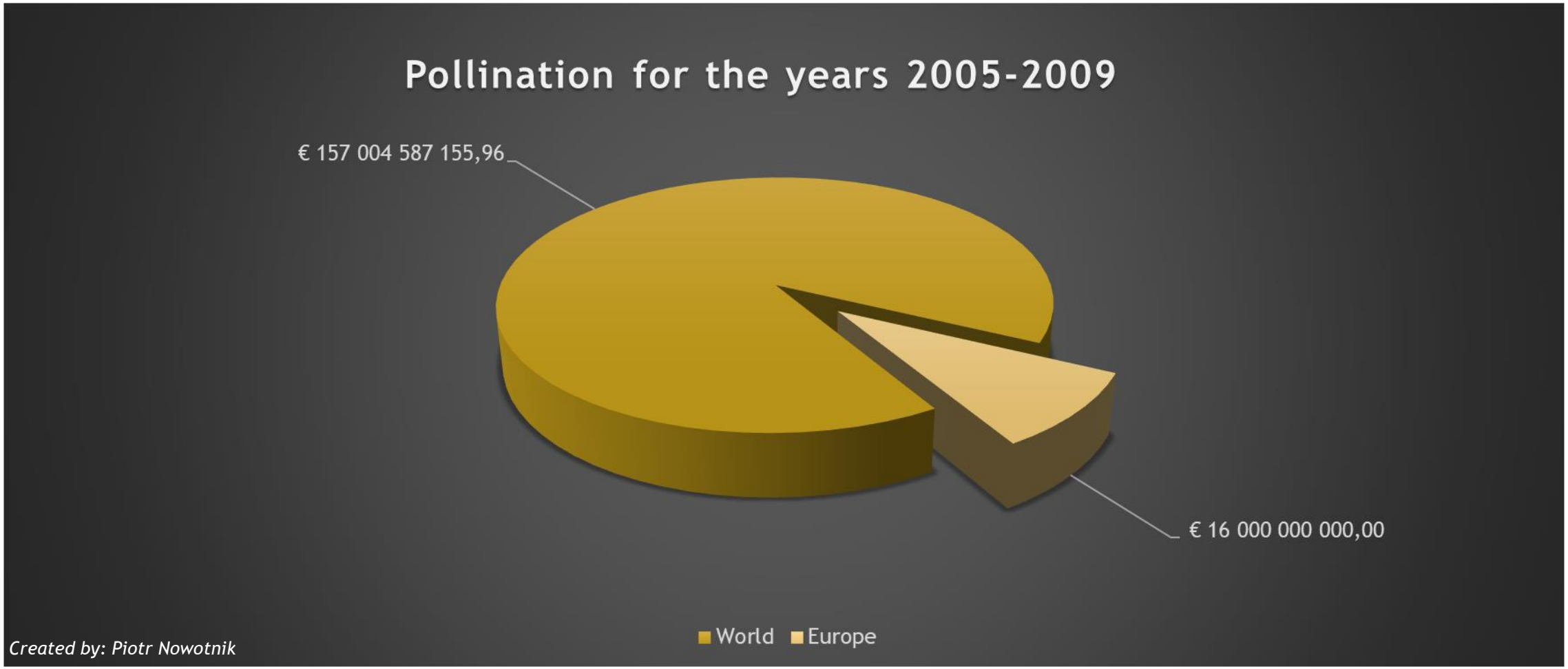
WITHOUT BEES

Global production food with bees and without bees

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

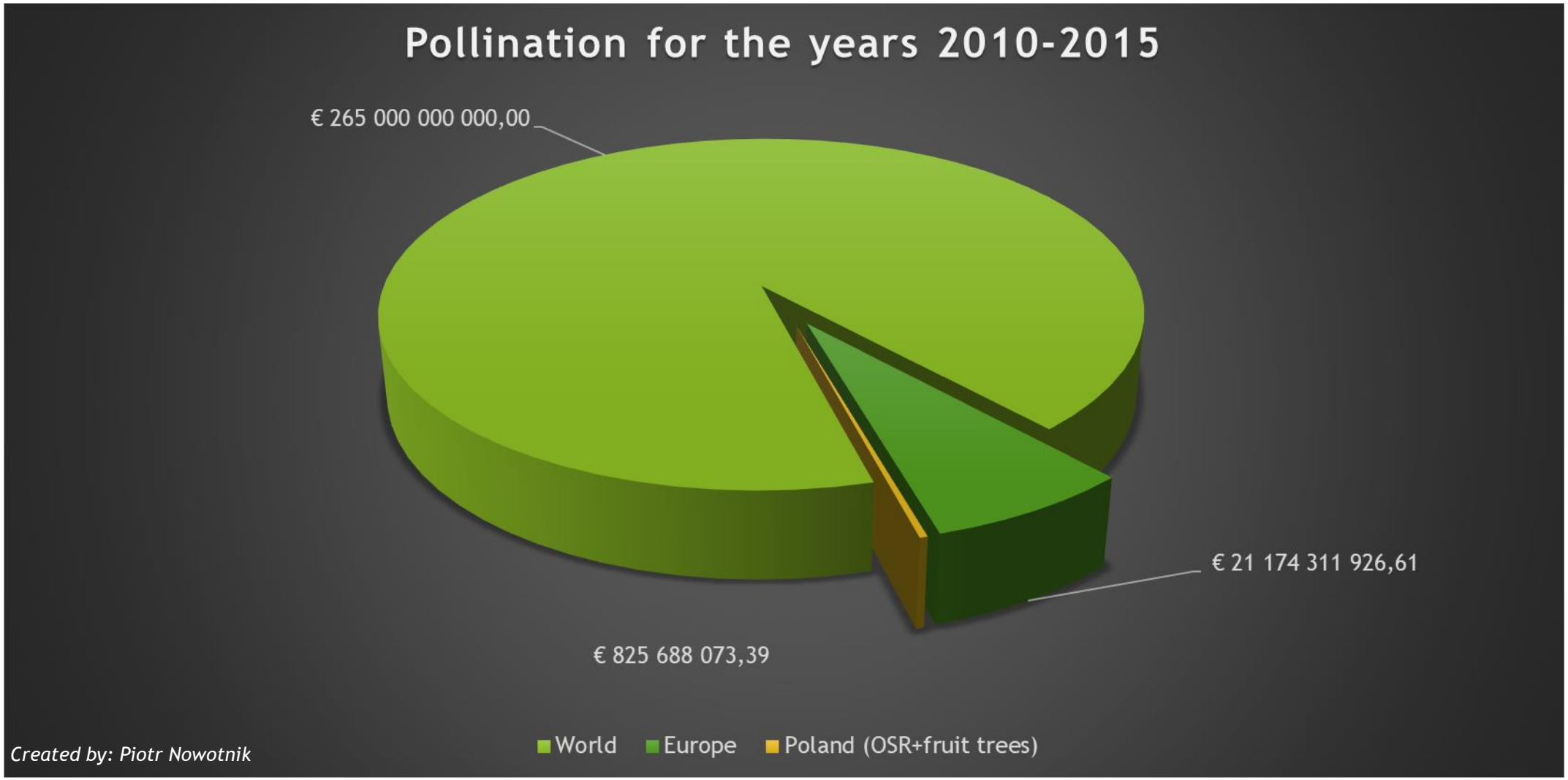
Global production food with bees and without bees

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



Global production food with bees and without bees

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



Global production food with bees and without bees

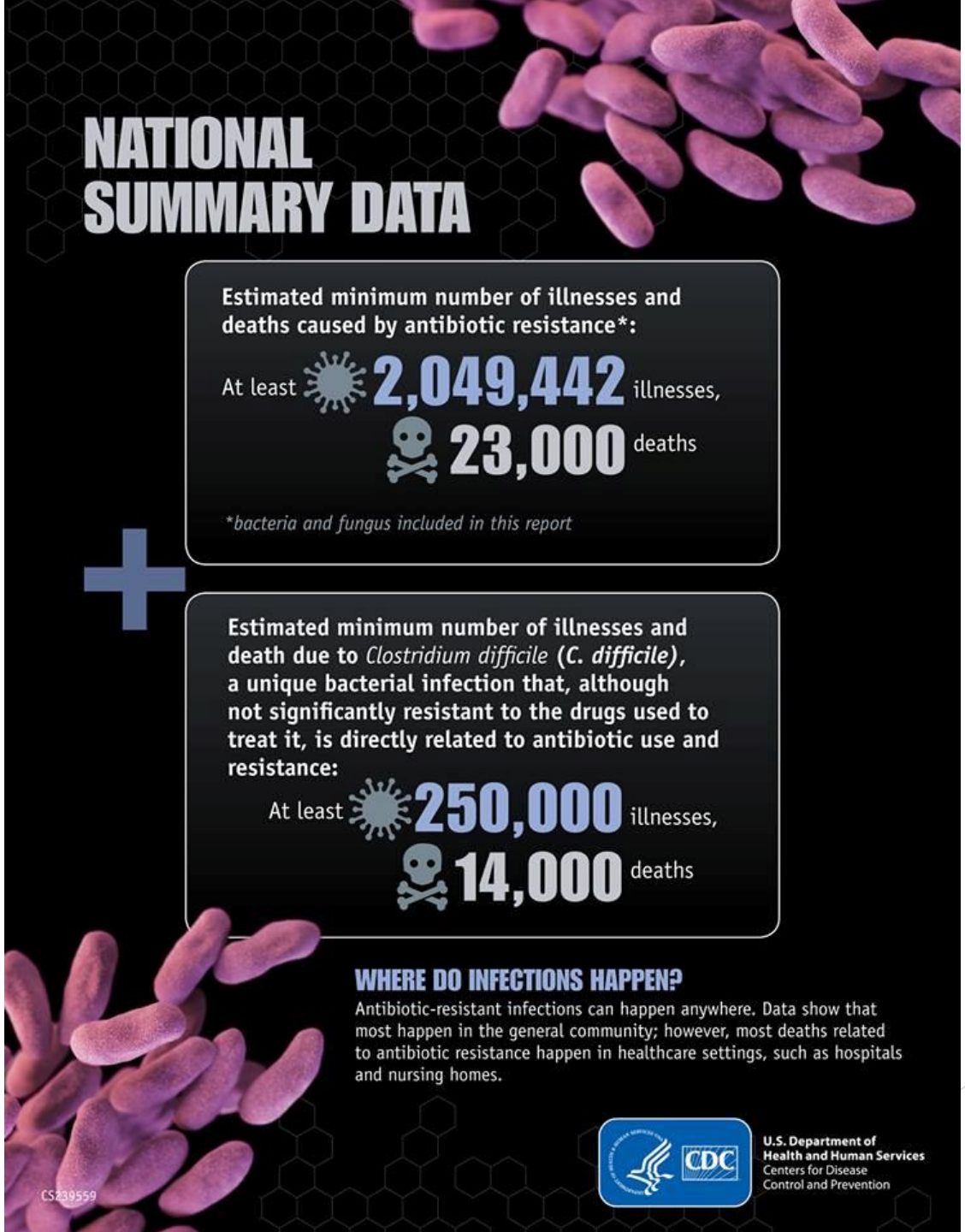
Thank you bees!

If a last bee will die, then…

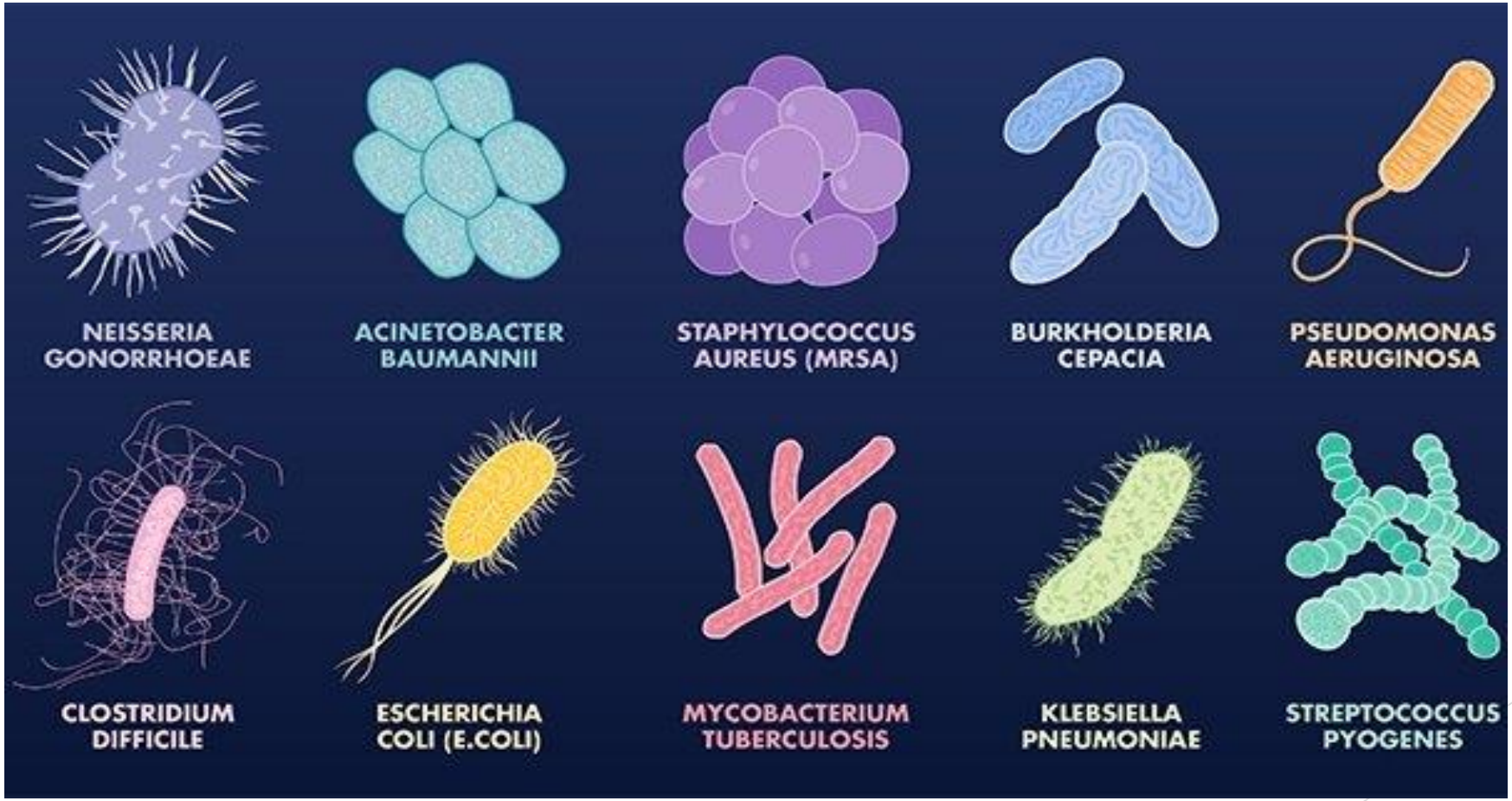
- Extinct 75 % plants;
- Decreasing a production of food in 1/3 in the world;
- Inheritance of agriculture production;
- Producing animal feeds will be not possible;
- Won’t buy apples, onions, carrot, lemons, broccoli, peppers, coffe, tea, avocado, cucumbers;
- Food will be more expensive;
- Economy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

Global production food with bees and without bees

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.
CDC
U.S. Department of Health and Human Services
Centers for Disease Control and Prevention
CS239559

It's ready to attack and kill you!



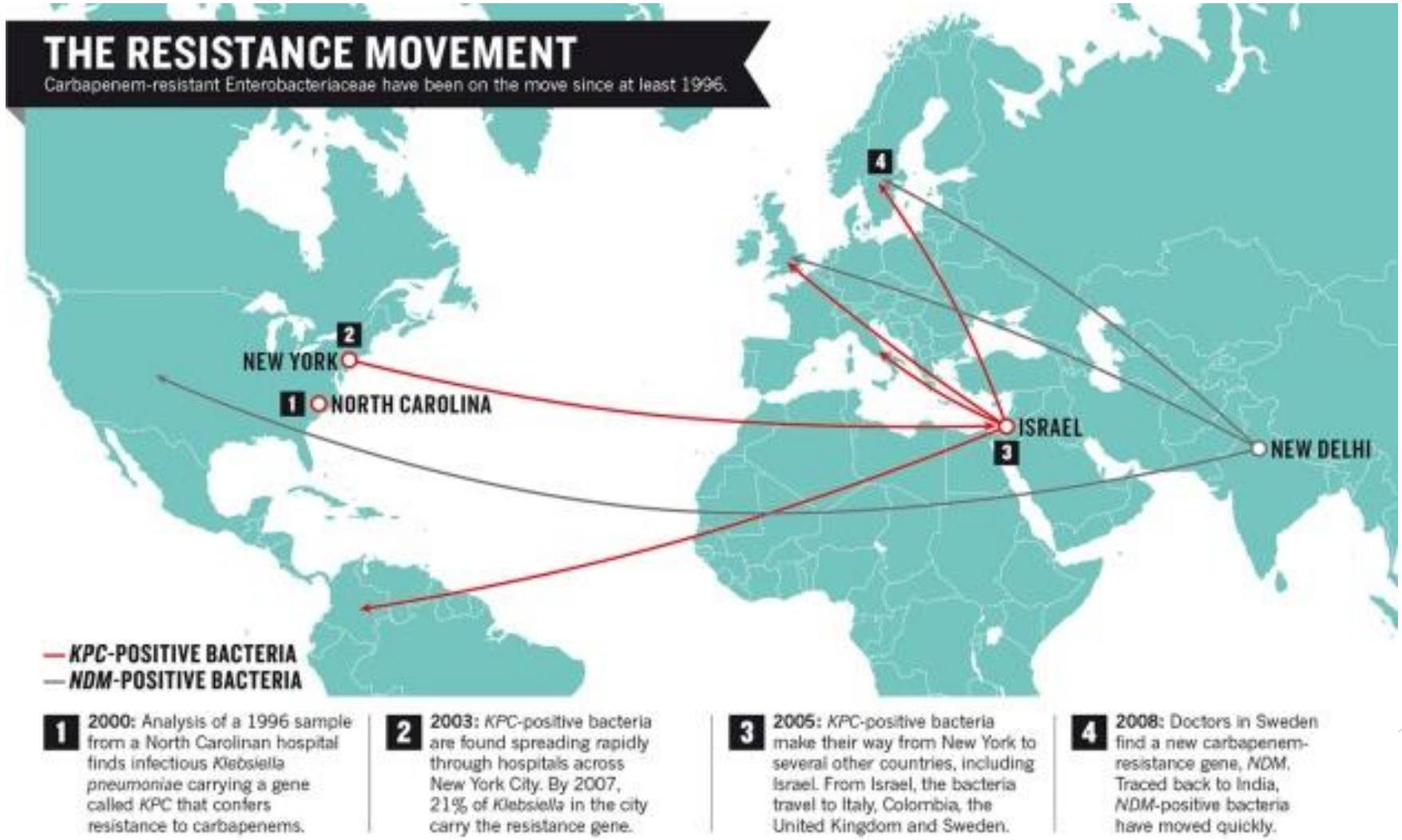
Global trouble

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

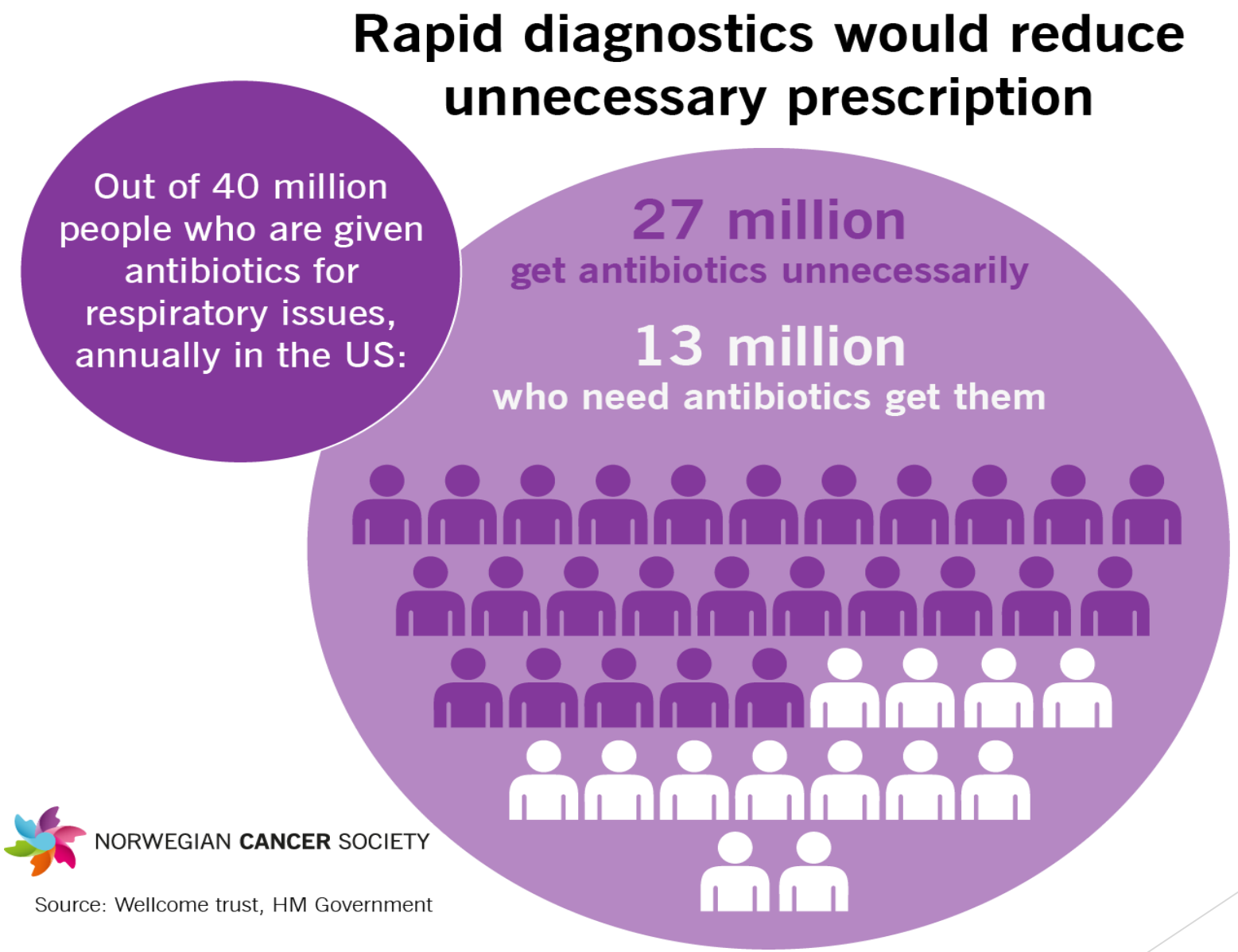
10m deaths by 2050

Costing £66 trillion

The resistance is rising up



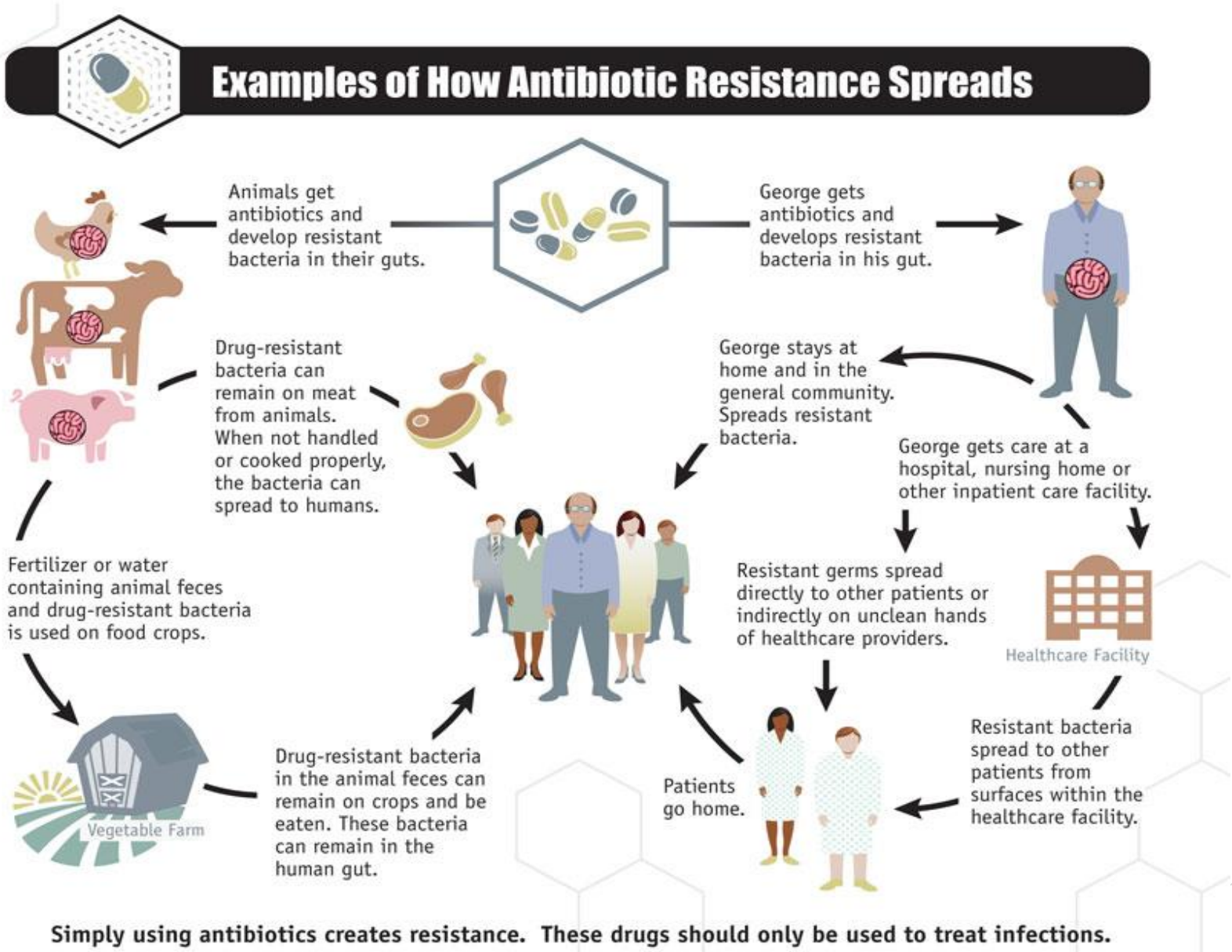
How should we react?



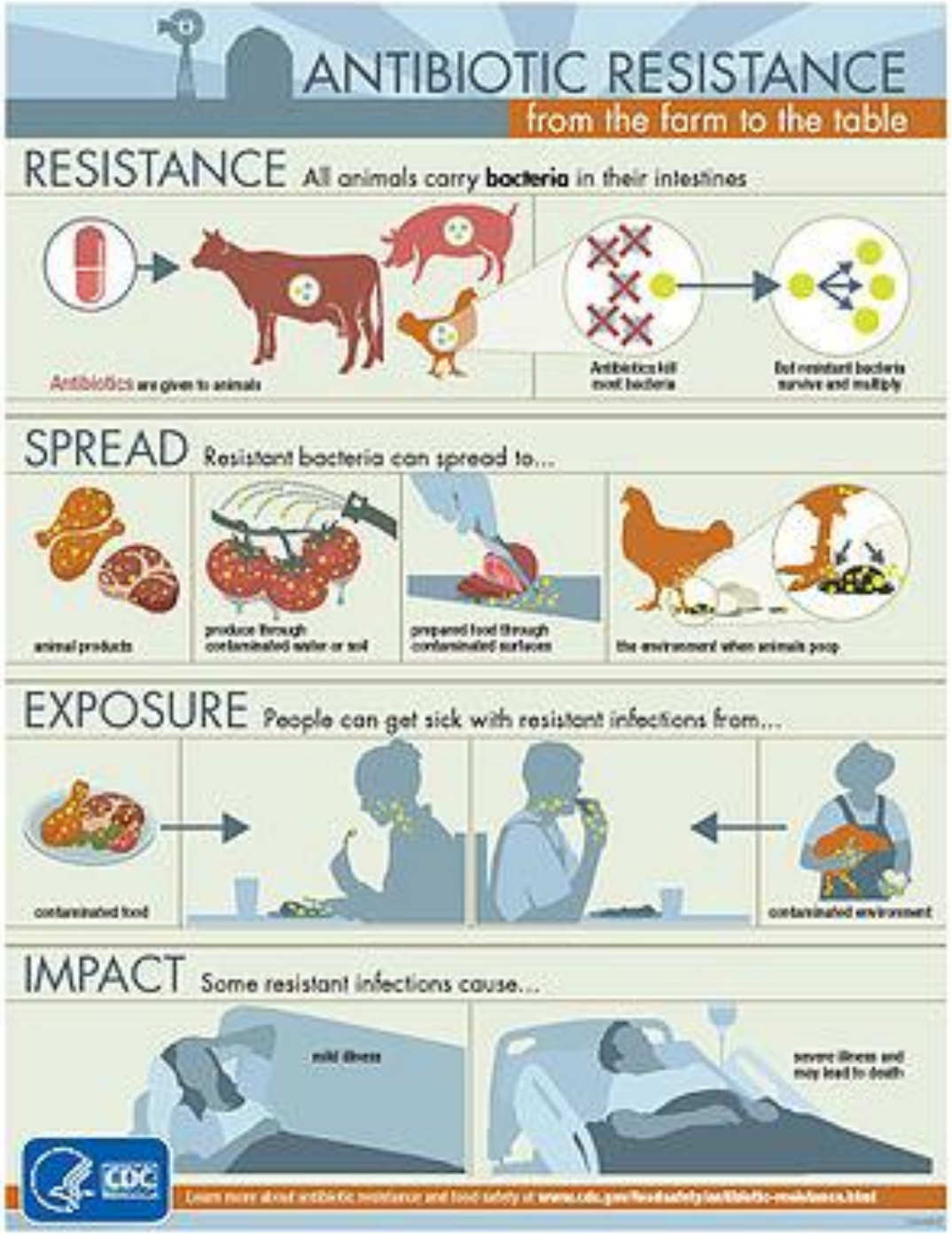
NORWEGIAN **CANCER** SOCIETY

Source: Wellcome trust, HM Government

Sources of growing resistance

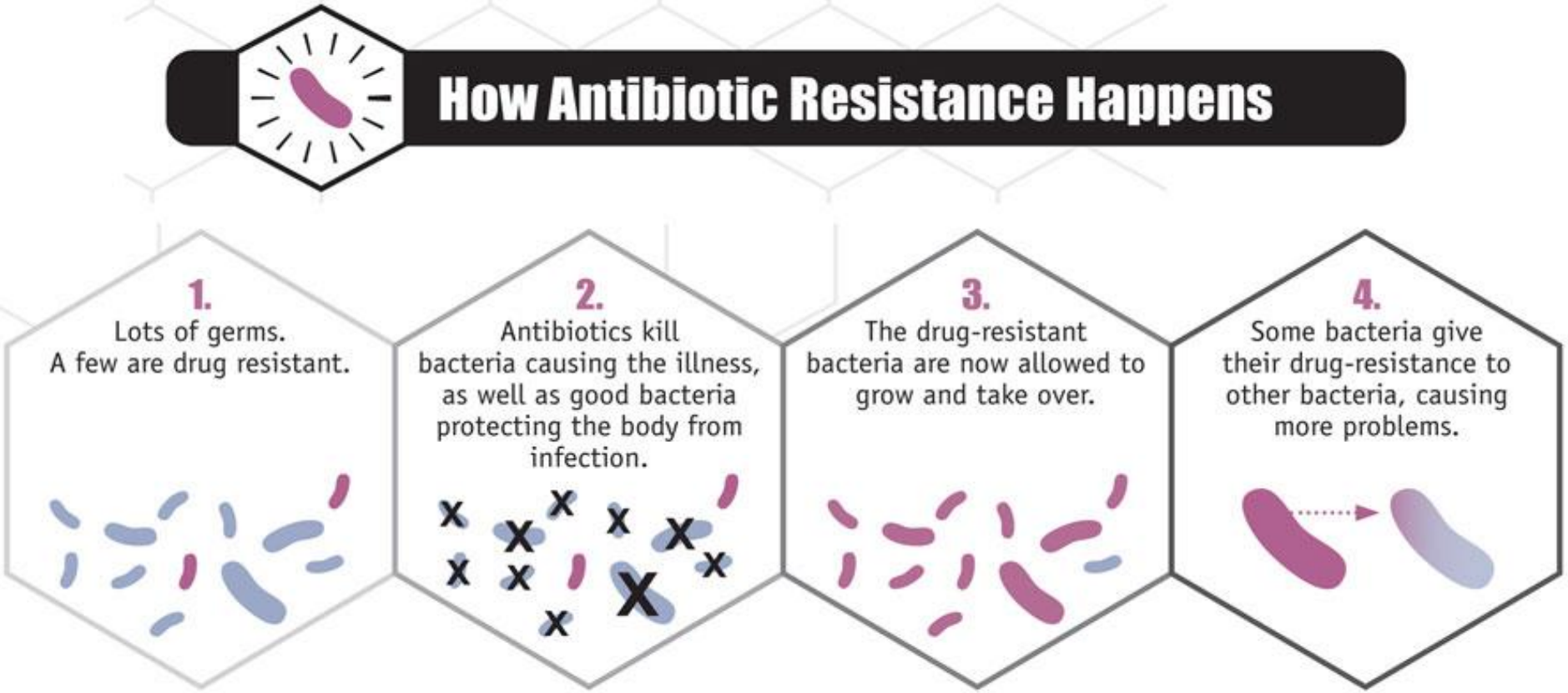


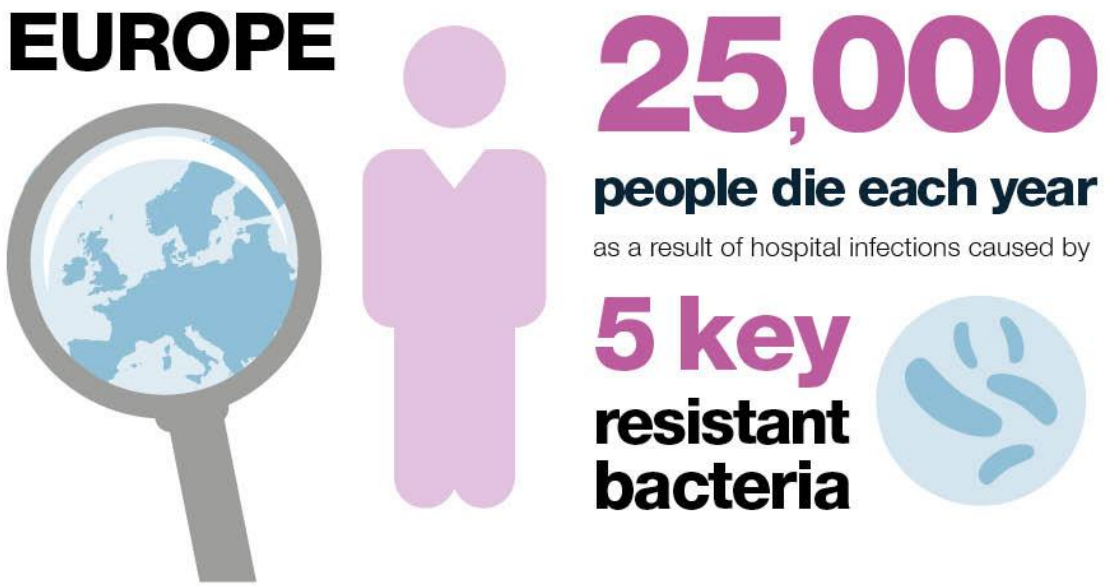
Simply using antibiotics creates resistance. These drugs should only be used to treat infections.



The chain of spreading antibiotcis in ecosystem

Creating of resistance behaviour




EUROPE
25,000
people die each year
as a result of hospital infections caused by
5 key
resistant
bacteria

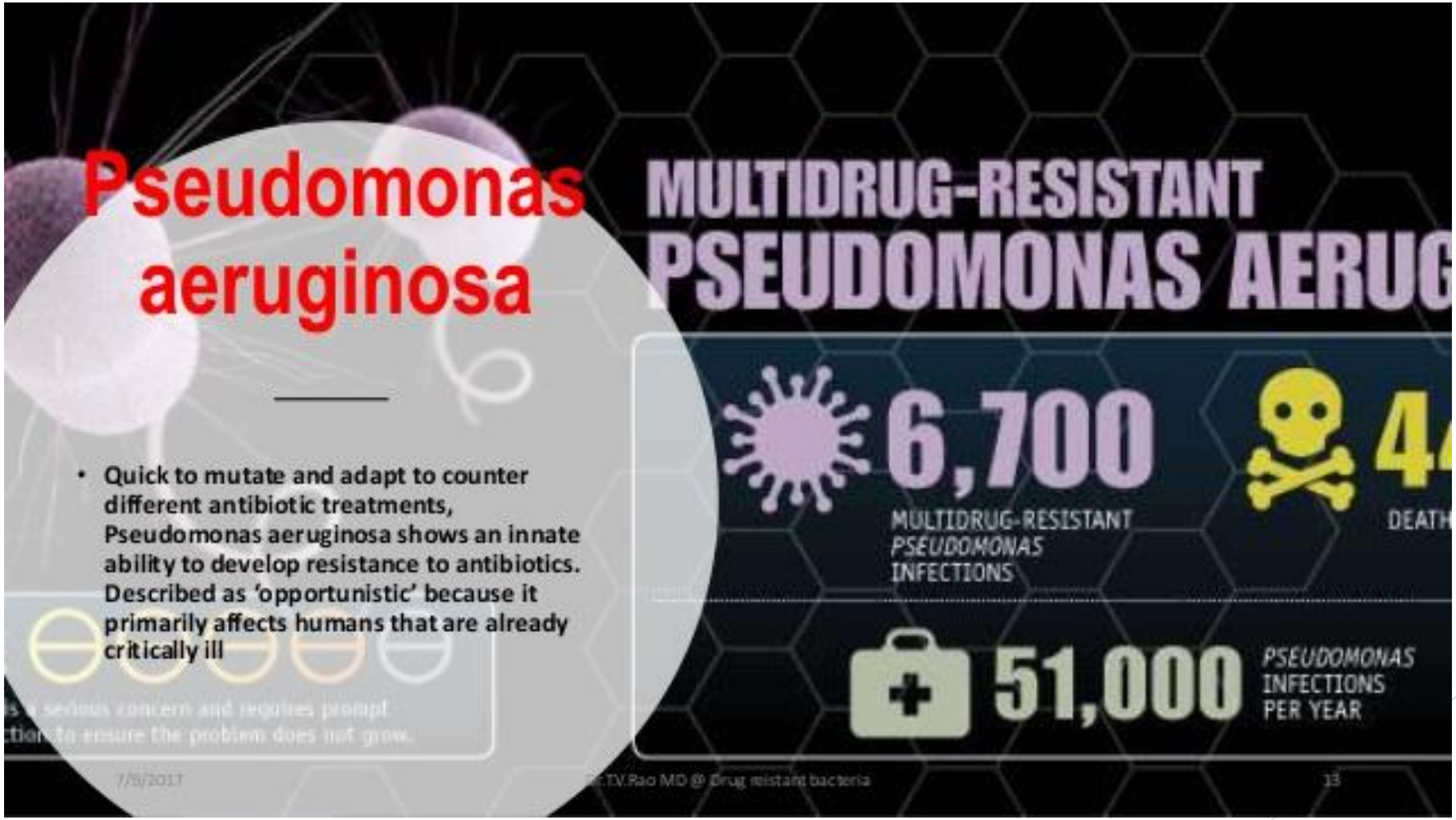
Chosen and dangerous!!!

MRSA - the most dangerous pathogens

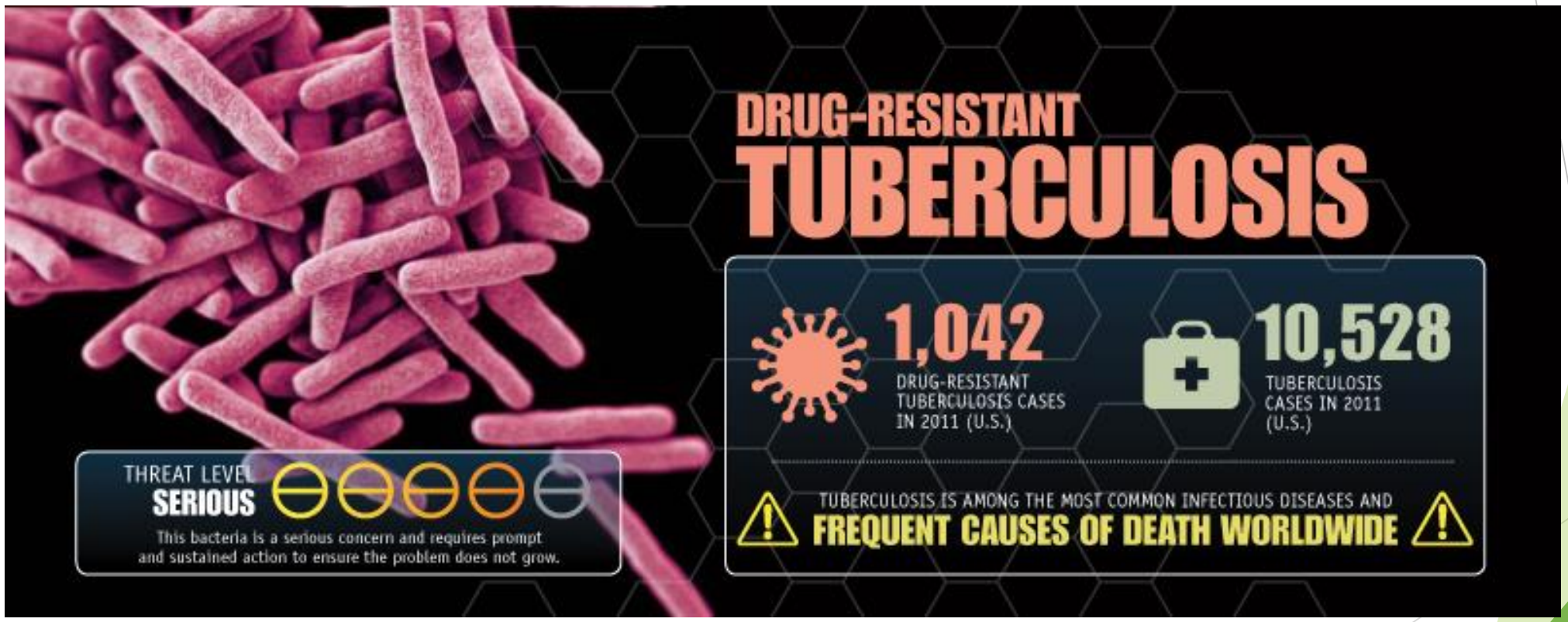
Staphylococcus aureus (MRSA)

- 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.

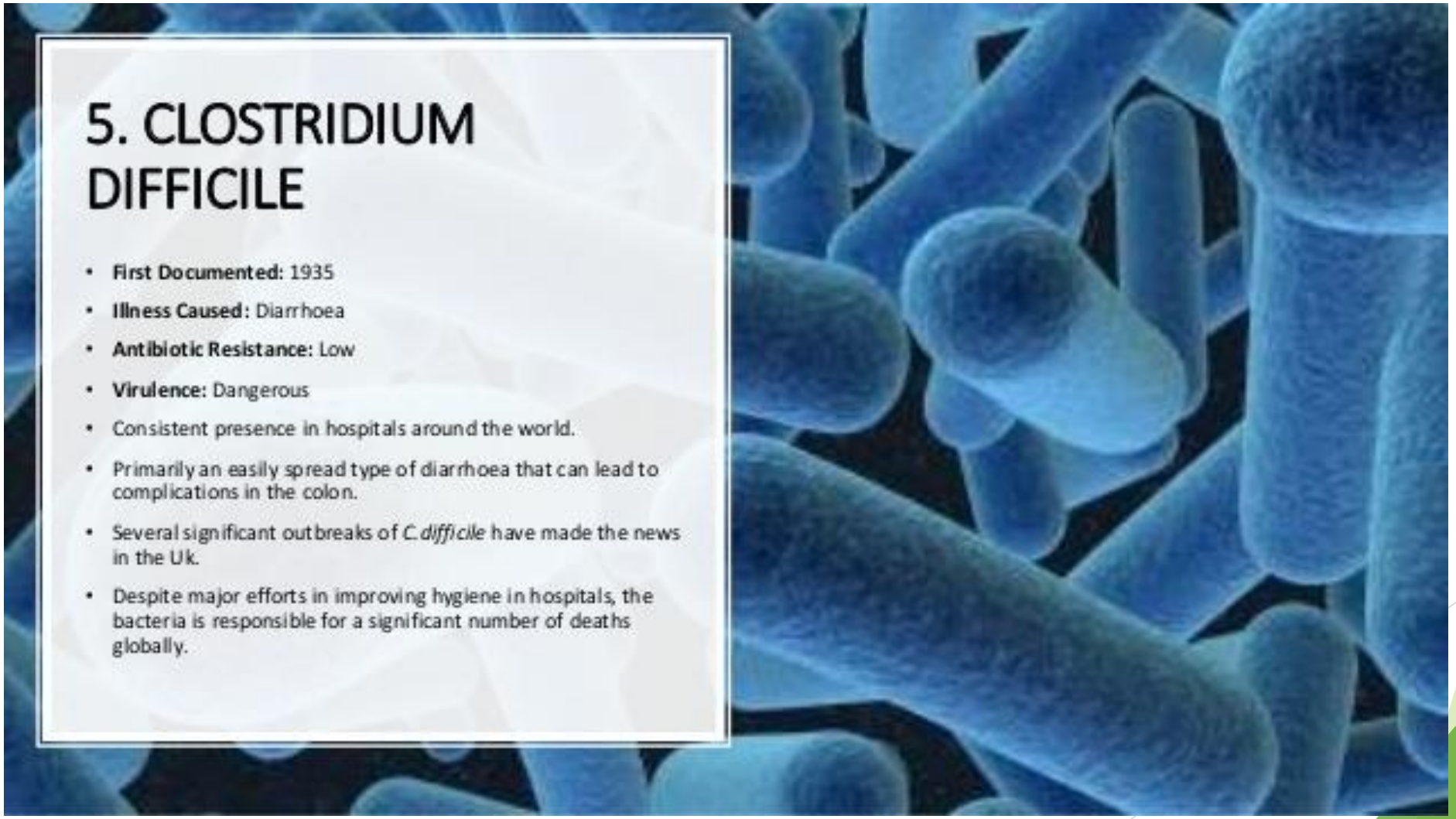
Pseudomonas aeruginosa



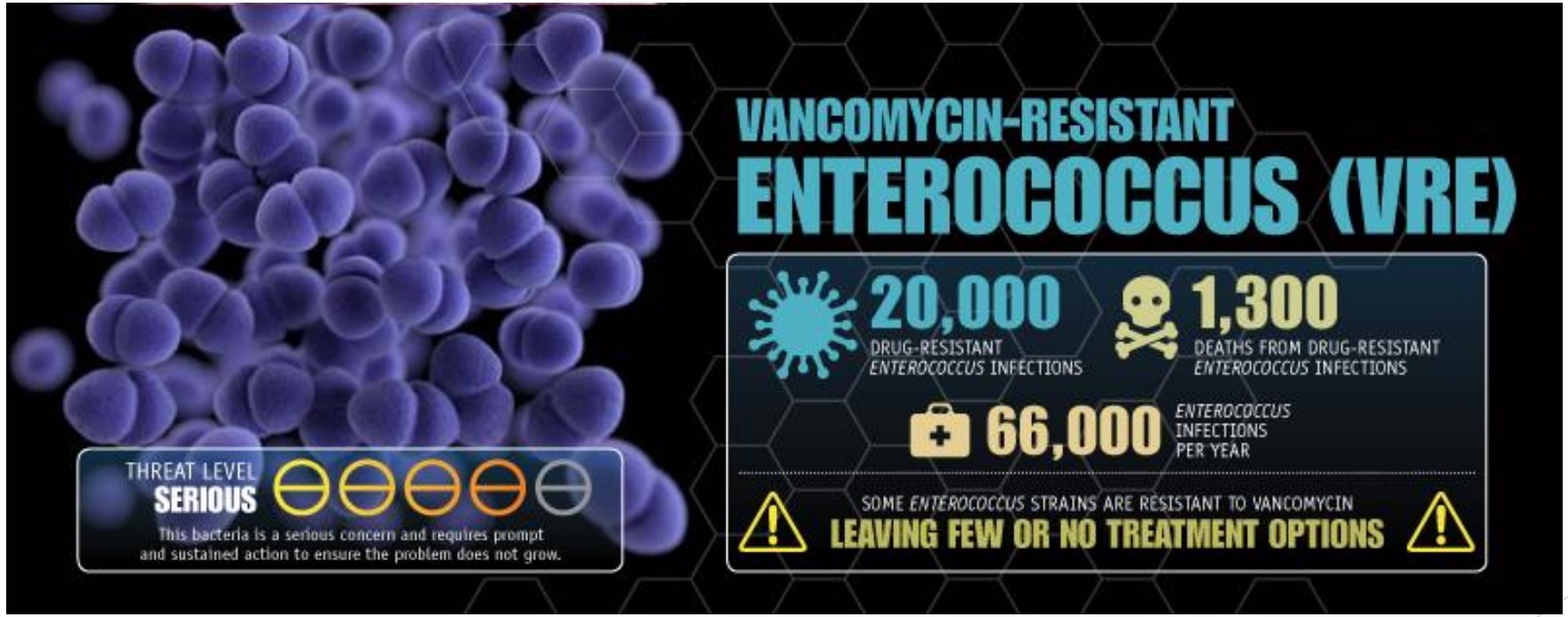
Mycobacterium tuberculosis



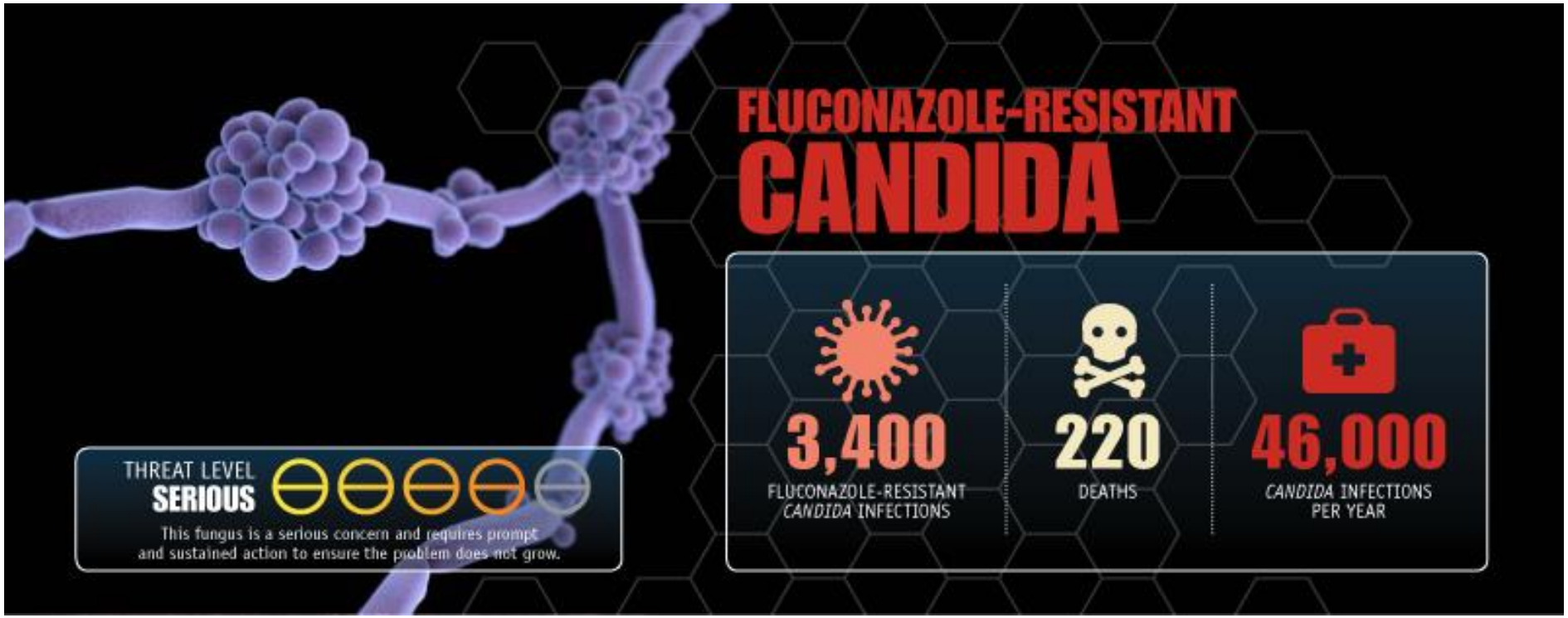
Clostridium difficile



Enterococcus spp.



Candida spp.


FLUCONAZOLE-RESISTANT
CANDIDA
THREAT LEVEL
SERIOUS
This fungus is a serious concern and requires prompt and sustained action to ensure the problem does not grow.
3,400
FLUCONAZOLE-RESISTANT CANDIDA INFECTIONS
220
DEATHS
46,000
CANDIDA INFECTIONS PER YEAR

Shigella spp.

Streptococcus pneumoniae

Disc-diffusion method - know how

What should we do?

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 H2O2 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 microrganisms. 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	
Staphylococcus aureus	≥ 30
Streptococcus pyogenes	≥ 30
Enterococcus faecalis	≥ 30
Pałeczki Gram-ujemne tlenowe	
Escherichia coli	≥ 30
Klebsiella pneumoniae	≥ 30
Proteus mirabilis	≥ 30
Proteus (inne gatunki)	16-28
Pseudomonas aeruginosa	≤ 14
Bakterie tlenowe	
Bacteroides fragilis	≥ 30
Clostridium walchii	≥ 30
Clostridium tetani	≥ 30
Clostridium oedematiens	≤ 14
Strefy zahamowania wzrostu szczepów: ≥ 30 mm – szczepy wrażliwe; 16-28 mm – szczepy średnio wrażliwe; ≤ 14 mm – szczepy oporne	

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

[1]*Enterococcus faecalis* (3), *E. avium* (1), *E. raffinosus* (1)
MRSA+ (szczepy oporne na metacylinę)
VRE+ (szczepy oporne 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[1]	17	2,0-11,0
Cooper i Molan (17)	*Pseudomonas* sp.[2]	20	5,5-8,7
Cooper i wsp. (18)	*Staphylococcus aureus*[3]	58	2,0-3,0
Cooper i wsp. (19)	*Burkholderia cepacia*[4]	20	2,9-6,9
Allen i wsp. (20)	*Staphylococcus aureus* MRSA i VRE[5]	142	4,1-13,7
Cooper (21)	Bakterie izolowane z zakażonych ran[6]	18	3,2-9,0
Cooper i wsp. (22)	*Pseudomonas aeruginosa*[7]	17	5,5-12,3
Cooper i wsp. (23)	Bakterie izolowane z zakażonych ran[8]	45	4,1-6,9
French i wsp. (24)	Bakterie izolowane z materiału zakaźnego[9]	18	4,1-5,5
Mullai i Menon (25)	*Pseudomonas aeruginosa*[10]	152	20,0

Pałeczki Gram-ujemne: *Escherichia coli*, *Salmonella* sp., *Shigella* sp., *Vibrio* sp., *Yersinia enterocolitica*, *Campylobacter jejuni*
Pałeczki izolowane z zakażonych ran
Ziarniaki izolowane z zakażonych ran
Pałeczki izolowane od chorych z mukowiscydozą
Ziarniaki oporne na metycylinę i wankomycynę
Ziarniaki Gram-dodatnie: *Staphylococcus aureus* MRSA (oporne na metycylinę), *Enterococcus faecalis*; pałeczki Gram-ujemne: *Escherichia coli*, *Klebsiella oxytoca*, *Proteus morganii*, *Proteus mirabilis*, *Serratia marcescens*
Pałeczki izolowane z zakażonych ran oparzeniowych
Ziarniaki Gram-dodatnie: *Staphylococcus aureus* MRSA (oporne na metycylinę), *Enterococcus faecalis*, *Enterococcus faecium* i 2 inne gatunki *Enterococcus* – wszystkie oporne na wankomycynę
Ziarniaki *Staphylococcus epidermidis* i 4 inne gatunki *Staphylococcus* izolowane z krwi, płynu mózgowego, wydzieliny oskrzelowej i zgłębników
[9]Pałeczki 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[1]	2	19,3; 12,3
Irish i wsp. (27)	*Candida* sp.[2]	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