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Antibiotic Resistance

Karley J. Trow

Cedarville University, karleytrow@cedarville.edu

Parker N. Savard

Cedarville University, parkersavard@cedarville.edu

MaryLou Mumme

Cedarville University, maryloumumme@cedarvill.edu

Brandon M. Christen

Cedarville University, brandonmchristen@cedarville.edu

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Antibiotic Resistance

Brandon Christen, MaryLou Mumme, Parker Savard, Karley Trow
Cedarville University School of Pharmacy



Impact on Pharmacy

Early Years

- First antibiotics were used to treat gangrene in World War II¹¹
- Praised as “miracle drugs” by the public and professionals alike, leading to overuse¹¹

Towards Recent Concern

- Anthrax '01
 - Envelopes of deadly white powder containing *Bacillus anthracis* arrive in the mail¹¹
 - Overuse of ciprofloxacin leads to immunity¹¹
- The new fad of antibiotic-free meats
 - Pharmacists make concerted efforts to reduce unnecessary consumption of antibiotics in meat⁸
 - Demonstrated in restaurants and meat packaging⁸

Trajectory of the Issue

Once-treatable bacteria emerge as resistant strains

- *Staphylococcus aureus*
 - Then: treated with penicillin¹⁴
 - Now: MRSA (methicillin-resistant) strains persistently show new immunities¹⁴
- *Mycobacterium tuberculosis*
 - Then: treated with isoniazid and rifampicin and effectively eliminated in the West
 - Now: emerging incidence of tuberculosis resistant to both isoniazid and rifampicin¹⁷
 - Chances of survival: ~50%¹⁷

The Science of Antibiotic Resistance

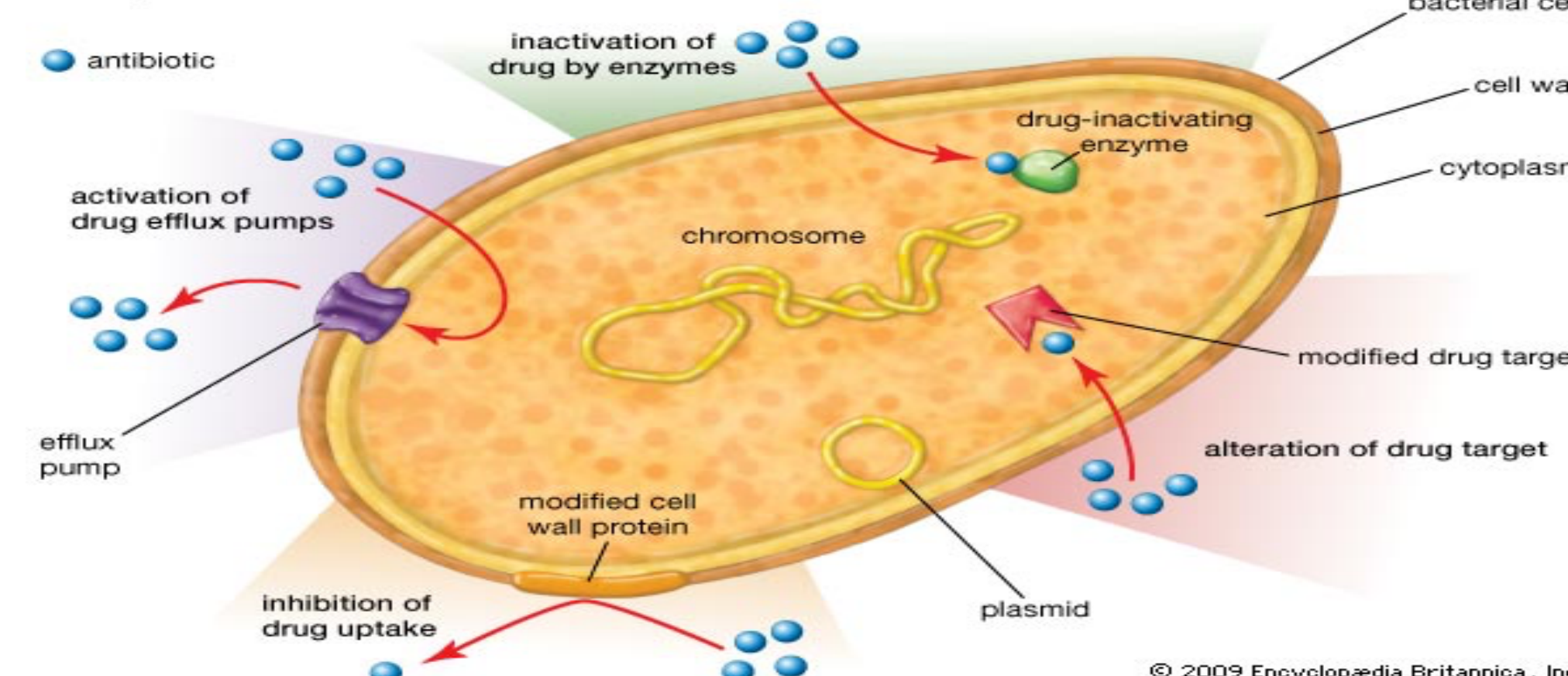
Genetics and Biochemistry

Genetics

- Rapid reproduction rate of bacteria leads to an abundance of mutated genes that are beneficial for resisting antibiotics²
- Antibiotic-resistant DNA can be transferred to other members of the population via horizontal gene transfer⁹

Biochemical Mechanisms

Examples of mechanisms of antibiotic resistance



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Overview

Antibiotic Resistance is the tendency of disease-causing bacteria populations to develop immunities to the fatal effects of antibiotic drugs.

Antibiotic Resistance is a Serious Clinical Problem

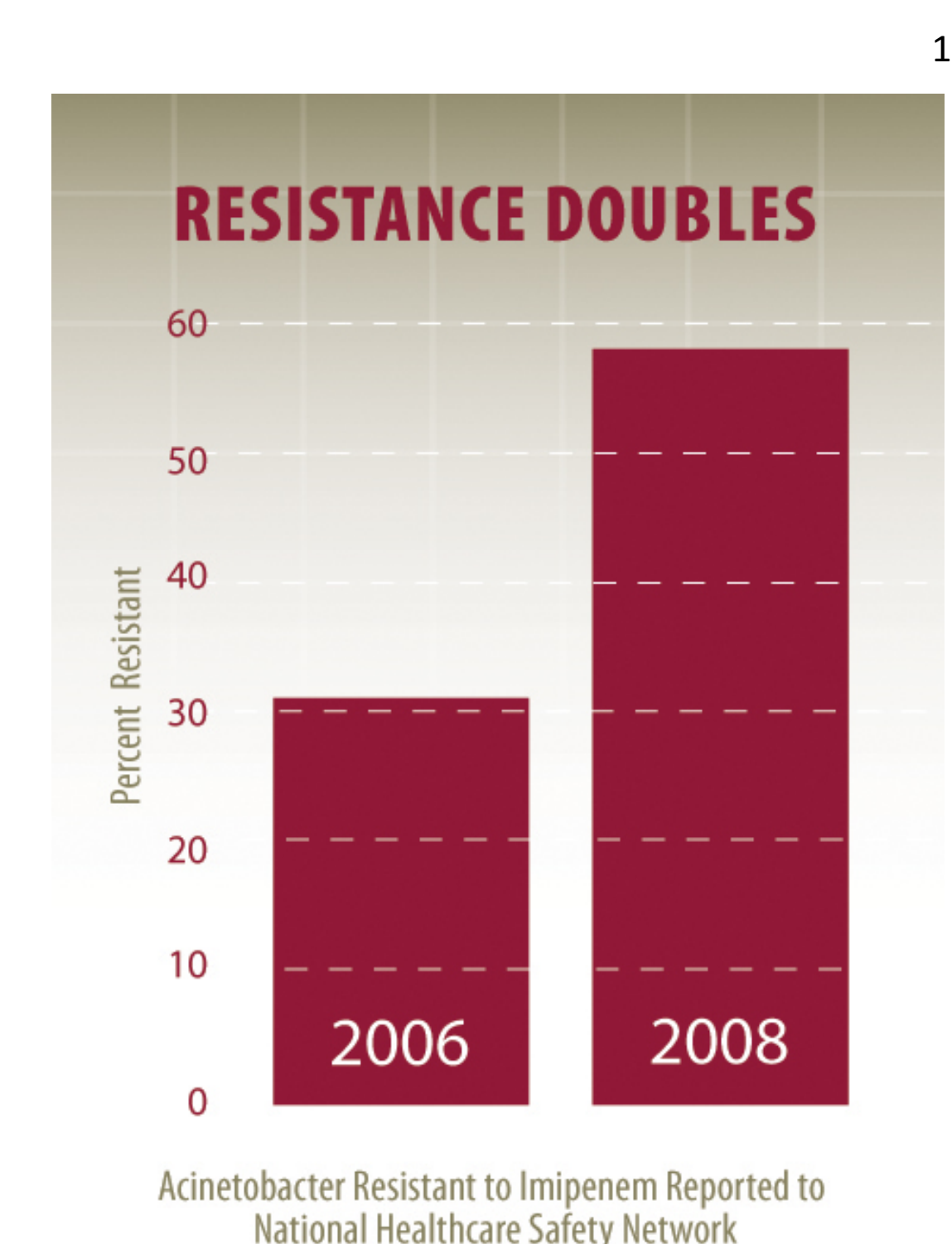
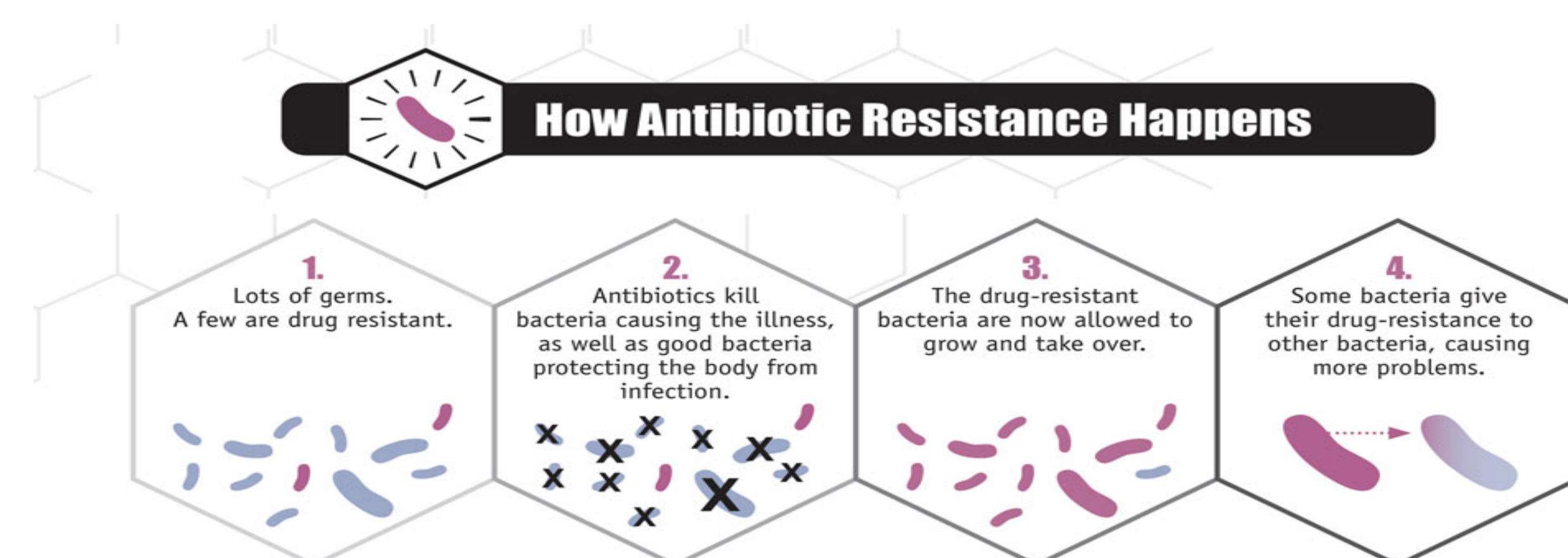
- Many of our most trusted antibiotics are losing their power over disease-causing bacteria²⁰

Further Resistance is Inevitable

- Bacteria will continue to evolve and adapt in order to escape death²⁰

The Fight is not Futile²⁰

- Research is still being done
- Ways to slow down resistance are being found
- New antibiotics will eventually be discovered



Reducing Incidence

The three big ways we can fight the trend of antibiotic resistance:

Infection Prevention^{18, 21}

- Eliminates need for antibiotics on individual bases
 - Hygiene and nutrition
 - Vaccines
 - Less-invasive surgeries and procedures

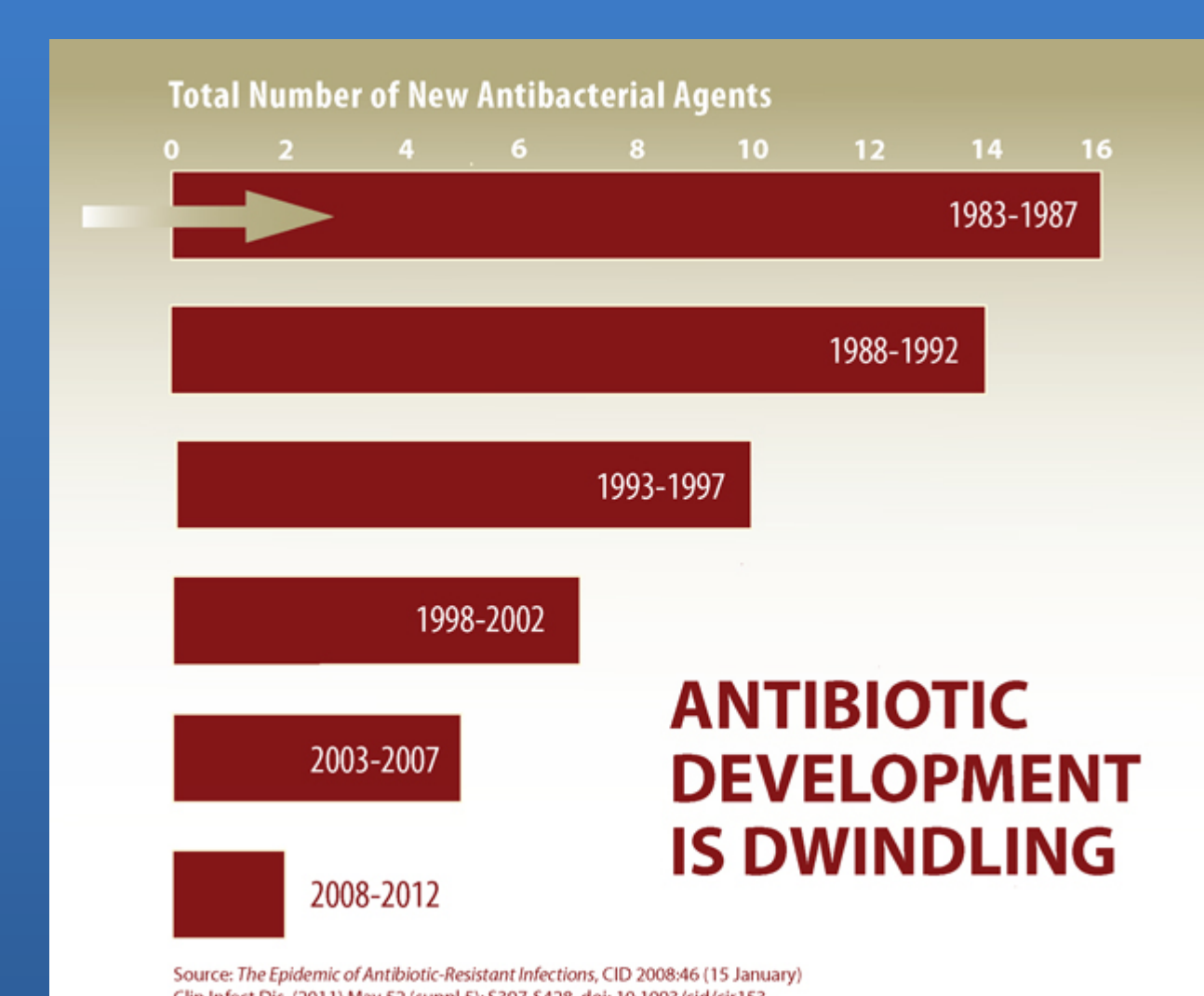
Stewardship of Resources

- Takes responsibility for the problem¹³
 - Education of students and professionals
 - Accountability for prescribers
- Avoids consequences of misuse⁷
 - Longer hospital stays, more frequent doctor visits, stronger and more expensive drugs
 - Adverse drug events (ADE) and hypersensitivity

Research and Development

- Seeks long-term solutions
 - Development of therapies that do not drive resistance²¹
 - Targeting of disease-causing component²¹
 - Creative incentivization for pharmaceutical companies' investment in discovery research¹⁸

Did you Know?



Organizations at Work^{15, 16}

NARMS (National Antibiotic Resistance Monitoring System)

- Founded in 1996
- Keeps a close watch on upward trends in diseases and infections that may lead to increased antibiotic resistance
- Educate the public and promote awareness of infections
- Focus on resistance through food



Determinants of Health

Factors That Impact the Issue

Policy³

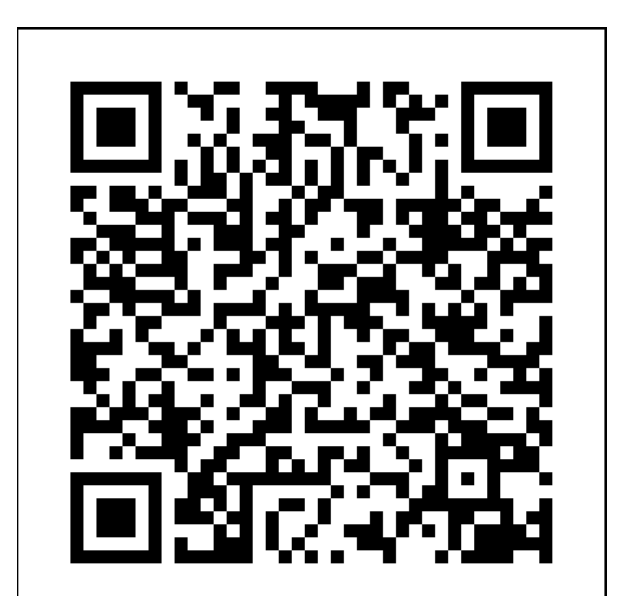
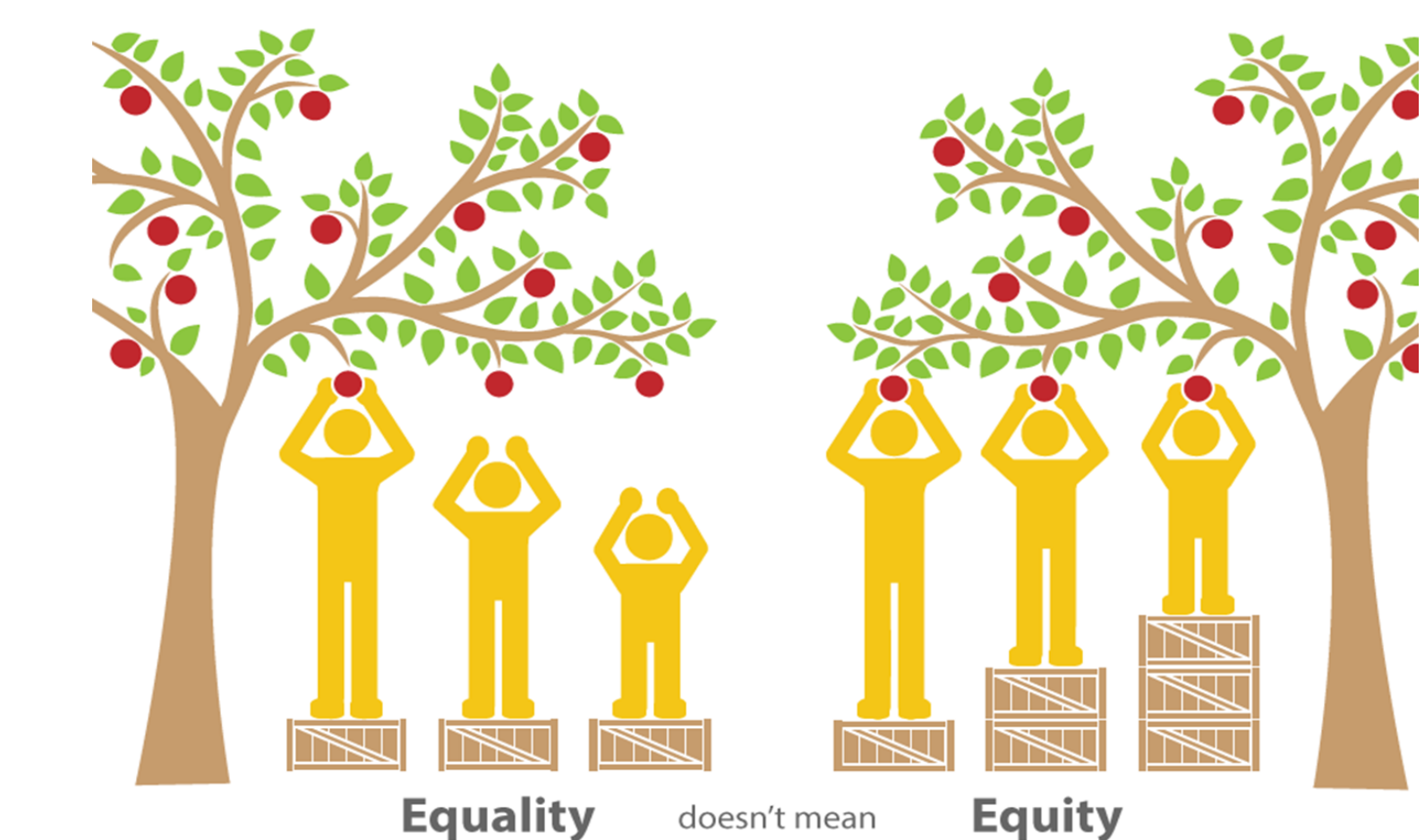
- Centers for Disease Control
 - Keeps track of disease outbreaks and closely watches the use of drugs on those diseases
 - Operates “public education campaigns to inform doctors and patients how the drugs should be used in humans”¹
- The National Institutes of Health
 - Funds research and studies towards antibiotics
- Generating Antibiotic Incentives Now (GAIN) Act
 - Signed by President Obama in 2011, GAIN limits the period that antibiotics can be sold with no generic competition to five years
 - National Action Plan for Combating Antibiotic-Resistant Bacteria (2015)

Health Services

- Resistant bacteria are often spread in hospitals through contact
- The accessibility of antibiotic drugs in the United States has made over-prescription easy for the medical community¹²
- Patient education is vital to fighting the issue on an individual level

Individual Behavior Choices

- The general public often misuses OTC antibiotics, increasing development of resistance¹²
- Patients need to adhere to directions for properly taking their prescriptions, including finishing antibiotic regimens



References

1. Antibiotic/Antimicrobial Resistance: Biggest Threats. Centers for Disease Control and Prevention website. https://www.cdc.gov/drugresistance/biggest_threats.html. September 8, 2016. Accessed November 4, 2017.
1. Antibiotic resistance. Funk & Wagnalls New World Encyclopedia [serial online]. 2016;1p. 1. Available from: Funk & Wagnalls New World Encyclopedia, Ipswich, MA. Accessed October 29, 2017.
1. Antibiotic Resistance. Health Affairs. <http://www.healthaffairs.org/doi/10.1377/hlthaff.2015.0521.42596/full/>. Published May 21, 2017. Accessed November 4, 2017.
2. Antibiotic Resistance in the Intensive Care Unit. Antibiotic Resistance in the Intensive Care Unit | Annals of Internal Medicine | American College of Physicians. <http://annals.org/aim/article-abstract/714294/antibiotic-resistance-intensive-care-unit>. Published February 20, 2001. Accessed November 2, 2017.
1. Antibiotic Resistance. World Health Organization. <http://www.who.int/mediacentre/factsheets/fs204/en/>. Accessed November 2, 2017.
2. Bartlett JG, Gilbert DN, Spellberg B. Seven ways to preserve the miracle of antibiotics. Clin Infect Dis. 2013;56(10):1445-1450.
3. Burdett SD. Sometimes necessary, but often dangerous. Antibiotic Stewardship. April 13, 2017.
4. Centner T. Efforts to slacken antibiotic resistance: Labeling meat products from animals raised without antibiotics in the United States. Science Of The Total Environment [serial online]. September 1, 2016;563-564:1088-1094. Available from: Agricola, Ipswich, MA. Accessed November 7, 2017.
7. George A. March of the superbugs. New Scientist [serial online]. July 19, 2003;179(2404):1. Available from: MasterFILE Premier, Ipswich, MA. Accessed November 7, 2017.
1. Hill E. Decision making about antibiotic use: examining the role of antibiotic resistance knowledge, concern, and previous inappropriate antibiotic use. Journal Of Communication In Healthcare [serial online]. October 2017;10(3):226-233. Available from: Communication & Mass Media Complete, Ipswich, MA. Accessed November 4, 2017.
1. How to stop antibiotic resistance? Here's a WHO prescription. World Health Organization. <http://www.who.int/mediacentre/commentaries/stop-antibiotic-resistance/en/>. Accessed November 2, 2017.
2. MRSA infection. Mayo Clinic. <https://www.mayoclinic.org/diseases-conditions/mrsa/basics/definition/con-20024479>. Published September 9, 2015. Accessed November 7, 2017.
3. National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS). Centers for Disease Control and Prevention. <https://www.cdc.gov/narms/faq.html>. Published December 16, 2016. Accessed November 2, 2017.
1. National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS). Centers for Disease Control and Prevention. <https://www.cdc.gov/narms/index.html>. Published January 20, 2017. Accessed November 2, 2017.
- 2017; Available from: Research Starters, Ipswich, MA. Accessed October 29, 2017.
1. Nogrady B. All you need to know about the 'antibiotic apocalypse'. BBC Future. <http://www.bbc.com/future/story/20161010-all-you-need-to-know-about-the-antibiotic-apocalypse>. Published October 11, 2016. Accessed October 27, 2017.
2. Salyers AA, Whitte DD. Revenge of the Microbes: how Bacterial Resistance is Undermining the Antibiotic Miracle. Washington, D.C.: ASM Press; 2005.
3. Savage S. What Would Be A Food Movement Worthy of the Name? science20. http://www.science20.com/agricultural_realism/what_would_be_food_movement_worthy_of_the_name?science20.
1. Seshasayee, Aswin Sai Narain. Antibiotic Resistance is Inevitable But Not Insupermountable. Thewire.in. April 1, 2016. Accessed November 2, 2017.
2. Spellberg B, Bartlett JG, Gilbert DN. The Future of Antibiotics and Resistance. The New England Journal of Medicine. 2013;368(4):299-302. doi:10.1056/NEJMp1215093.
1. Van Hoey N. Antibiotic resistance. Salem Press Encyclopedia Of Health. January 2017; Available from: Research Starters, Ipswich, MA. Accessed October 29, 2017.

Acknowledgments

Dr. Ginger Cameron
Cedarville University School of Pharmacy