Food, Agriculture and Water Research in One Health Era

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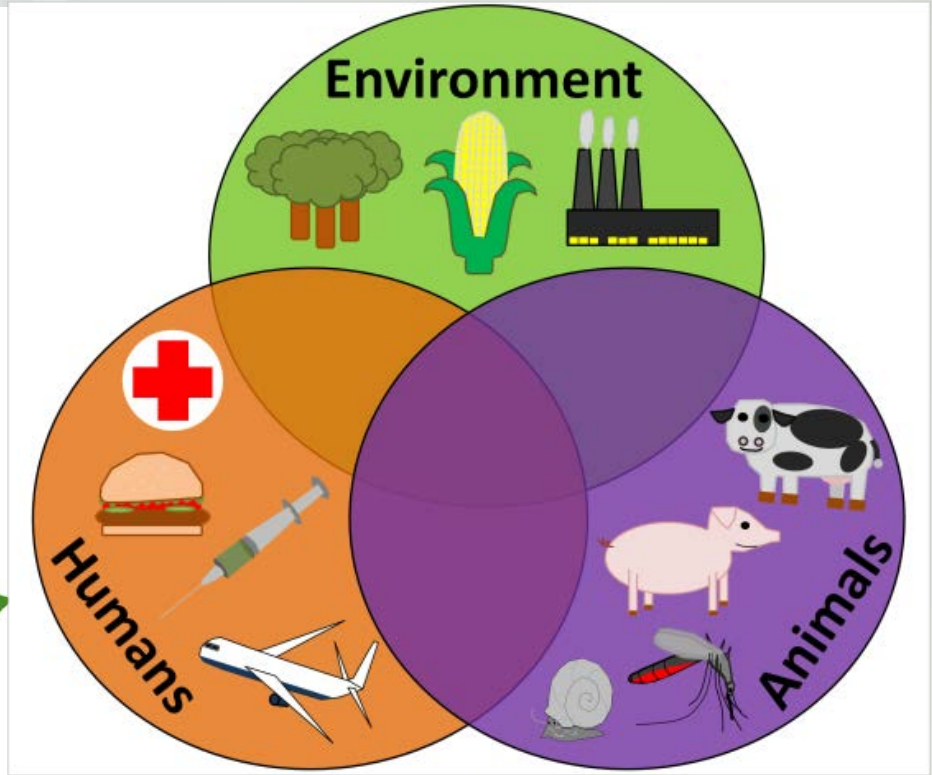
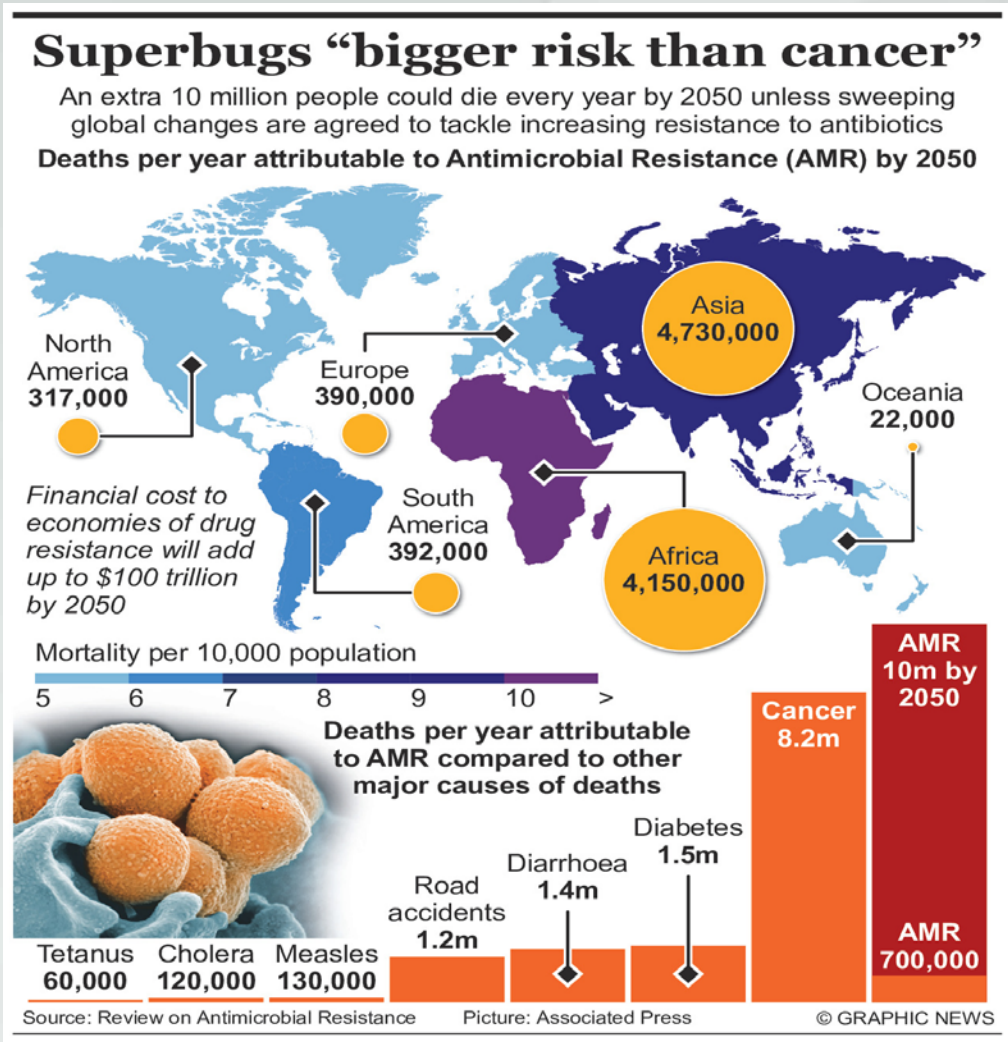
One Health: *The health of humans, other animals, and the environment are interdependent.*

One Health Concept of Antibiotic Resistance

Antibiotics → Superbugs → Drug-resistant infections



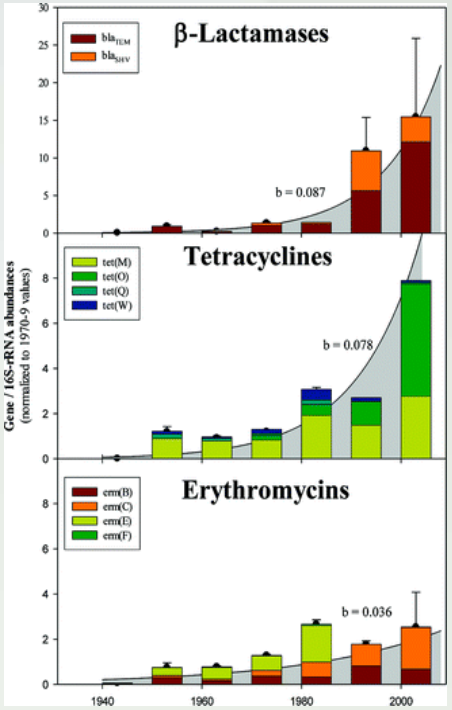
Pharmaceutical overuse & antibiotic resistance



Total Usages of All Antibiotics

country	year	usage (tons) total	human	animals
China	2013	162000	77760	84240
UK	2013	1060	641	420
USA	2011/2012	17900	3290	14600
Canada	2011	*b*	251	*b*
Europe	2003	*b*	3440	*b*

Zhang et al., 2015. ES&T, 49, 6772-6782



Increasing antibiotic resistance genes (ARGs) in soils

Knapp, C. W. et al. Environ. Sci. Technol. 2010

Antibiotics, antibiotic resistant bacteria and antibiotic resistance genes in agroecosystems

Human Medicine

Improper disposal

Excretion

Animal production

Manures
(Up to mg kg^{-1})

Wastewater treatment

Biosolids
(µg kg^{-1} to mg kg^{-1})

Reclaimed water
(ng L^{-1} to µg L^{-1})

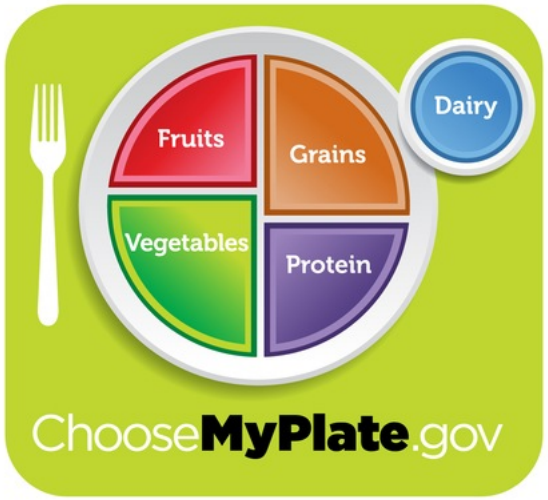
Crop production

On a landscape scale

Soil, water and plant systems

1. Microbiome and resistomes in soils
2. Plant uptake, resistomes and microbiomes under varying agricultural practices (e.g., irrigation method and manure management)

Antibiotic resistance in crops: A new frontier



microbial biotechnology
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Opinion

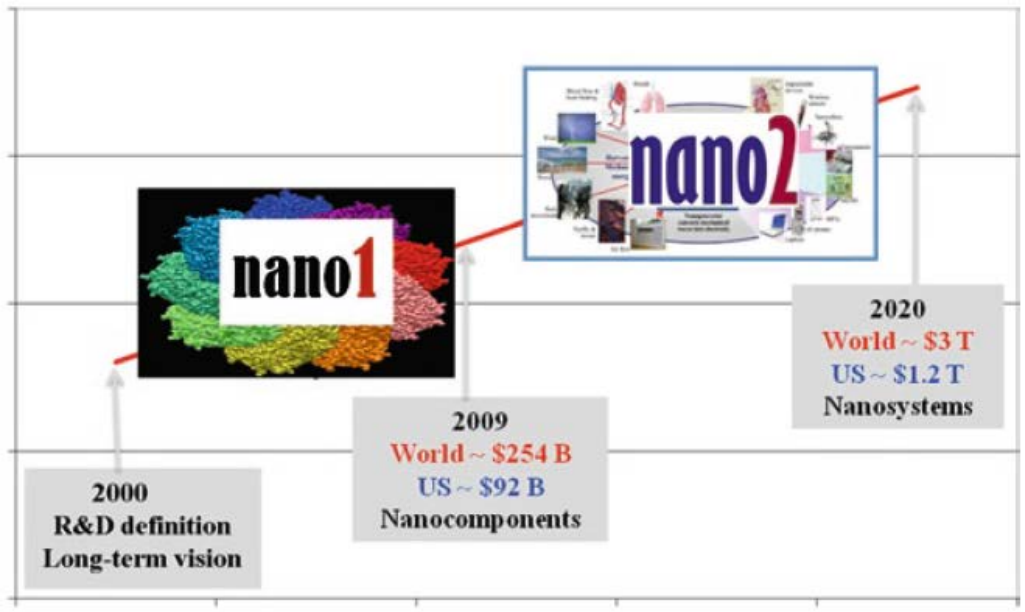
Vegetable microbiomes: is there a connection among opportunistic infections, human health and our 'gut feeling'?

Gabriele Berg,[1]* Armin Erlacher,[1] Kornelia Smalla[2] and Robert Krause[2]

pathogens are defined as causative agents of diseases, guided by Koch's postulates for more than a century and

- Vegetables are important parts of a healthy diet.
- Fresh vegetables with minimal processing are preferred.
- How do crops take up and transform pharmaceuticals?
- How are pharmaceutical residues, microbiomes, and antibiotic resistant bacteria in vegetables influenced by typical agricultural practices?

Contamination mechanisms of engineered nanoparticles in fresh produce and control strategies during processing



Consumer Products Inventory

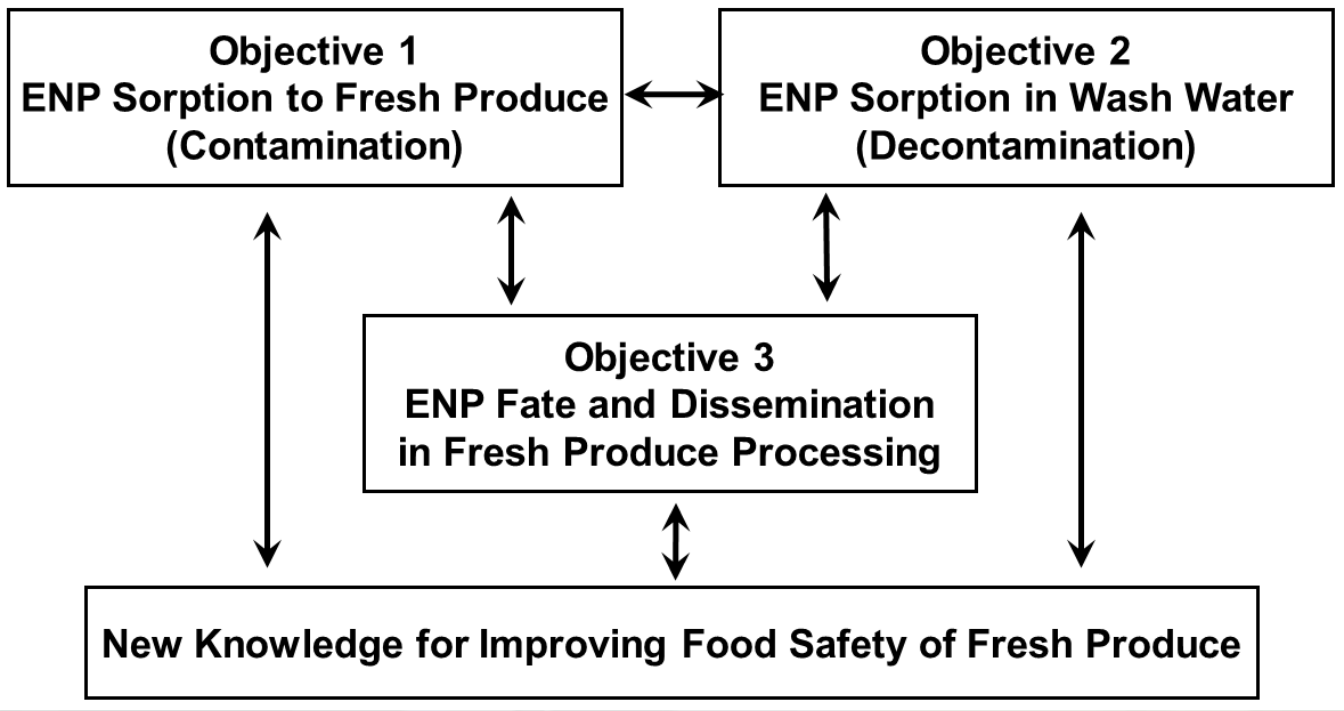
- 1814 consumer products from 622 companies in 32 countries.
- Nano-Ag is the most frequently used nanomaterial (435 products, or 24%).

The project on emerging nanotechnologies

- The Ag concentration in sewage sludge varied from 1.94 to 865 mg/kg.

  EPA Report (2009): Targeted National Sewage Sludge Survey Statistical Analysis.
- The predicted nano-Ag: 0.09-80 ng/L in surface water, 0.016-0.127 µg/L in wastewater effluents, and 1.29-6.24 mg/kg in sewage sludge.

  Mueller and Nowack, 2008; Gottschalk et al., 2009.



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